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DECAPOD CRUSTACEAN LARVAE COLLECTED DURING THE INTERNATIONAL INDIAN OCEAN EXPEDITION. FAMILIES RANINIDAE AND HOMOLIDAE

- 1 JAN 1971

A. L. RICE

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BY

ANTHONY LEONARD RICE

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DECAPOD CRUSTACEAN LARVAE COLLECTED DURING THE INTERNATIONAL INDIAN OCEAN EXPEDITION. FAMILIES RANINIDAE AND HOMOLIDAE

By A. L. RICE

SYNOPSIS

Five crustacean larvae belonging to the family Raninidae and two belonging to the family Homolidae are described from material collected during the International Indian Ocean expedition. Probable identities of the larvae are suggested where possible. Larval evidence for the relationship between the Homolidae, the Raninidae and the higher Brachyura is discussed.

INTRODUCTION

The larval stages of decapod crustaceans of the Indian Ocean are rather poorly known, few having been hatched from the adults and even fewer reared through all the larval stages. Consequently, only a very small proportion of larvae taken in the plankton in this region can be identified to species with any certainty, and in many cases identification even to family is difficult.

In those decapodan families in which the larval characteristics are already well known an account of plankton caught material of unknown specific or even generic identity is of doubtful value. On the other hand, the larvae of some families are so poorly known that any information on the developmental stages is of value, even if the material on which this information is based is at the moment unidentifiable. Such is the case with the crab-like families Raninidae and Homolidae, and although the I.I.O.E. collections contain very little material of either group a report on it is warranted.

Family **RANINIDAE**

Larval stages belonging to some ten species of raninids have been described previously, but in only three cases have the larvae been definitely identified with a known adult. *Ranina ranina* (L.) larvae were hatched from the egg by Aikawa (1941) and the first stage described. *Lyreidus tridentatus* de Haan larvae were reared from the egg to the moult from the 5th to the 6th (last) zoeal stage by Williamson (1965) who also had plankton caught megalopae which moulted in the laboratory to the first young crab stage. Finally, Knight (1968) reared larvae of *Raninoides benedicti* Rathbun taken from the plankton off the Pacific coast of Mexico, some specimens collected as first zoeae surviving into the early crab stages.

Two of the above species, *R. ranina* and *L. tridentatus*, have been recorded as adults from the Indian Ocean, but the larvae of the other eight recorded Indian

TABLE 1

Indian Ocean records of adult raninid crabs

Species	Locality	Source
Cosmonotus grayi Adams and White	Persian Gulf	Alcock, 1896
	Dar-es-Salaam	Doflein, 1904
	Holothuria Bank, 13° 35′S: 126°E	British Museum (Nat. Hist.)
Lyreidus channeri Wood-Mason	Bay of Bengal, 21° 6′30″N: 89° 20′E	Wood-Mason, 1886
	Bay of Bengal, 9° 14′10″N: 75° 46′E	Alcock, 1899
	Bay of Bengal	Alcock, 1896
	Andaman Sea	Alcock, 1896
	"Both sides of Ceylon"	Alcock, 1896
	Malabar Coast	Alcock, 1896
Lyreidus tridentatus de Haan	Dar-es-Sallaam	Doflein, 1904
	N.E. Laurenco Marques, Mozambique, 25° 32′S: 33° 24′E	U.S. Nat. Mus.
Notopus dorsipes (Fabr.)	Malabar Coast	Alcock, 1896
	Andamans	Alcock, 1896
	Zanzibar	Nobili, 1905
	Mauritius	Studer, 1882
Notosceles chimmonis Bourne	Amirante Islands	U.S. Nat. Mus.
	Seychelle Islands	U.S. Nat. Mus.
Notosceles viaderi Ward	Mauritius	Ward, 1942
Ranina ranina (L.)	Durban	Barnard, 1950
	Delagoa Bay	Barnard, 1950
	Zululand Coast	Barnard, 1950
	Mozambique Channel, 19° 5′S: 36° 21′E	U.S. Nat. Mus.
	Mozambique	Bianconi, 1851
	Mauritius	Bouvier, 1915
	Reunion	Hoffman, 1874
Raninoides hendersoni Chopra	Andaman Sea, 11° 49′50″N: 92° 52′E	Chopra, 1933b
Raninoides personatus White	Bay of Bengal, off the mouth of the river Hughli	Chopra, 1933a
	Bay of Bengal	Alcock, 1896
Raninoides serratifrons Henderson	Holothuria Bank	Henderson, 1893
	Off Cape Negrais, Burma 15° 25′N: 93° 45′E	Zool. Survey India
	Off Travancore coast, 9° 55′N: 75° 45′E	Zool. Survey India
	Off southern Ceylon, 6° 2′3″N: 81° 29′E	Zool. Survey India
	Ceylon	Laurie, 1906
	Ceylon	Alcock, 1896
	Malabar Coast	Alcock, 1896
	Port Shepstone, Natal	Barnard, 1950

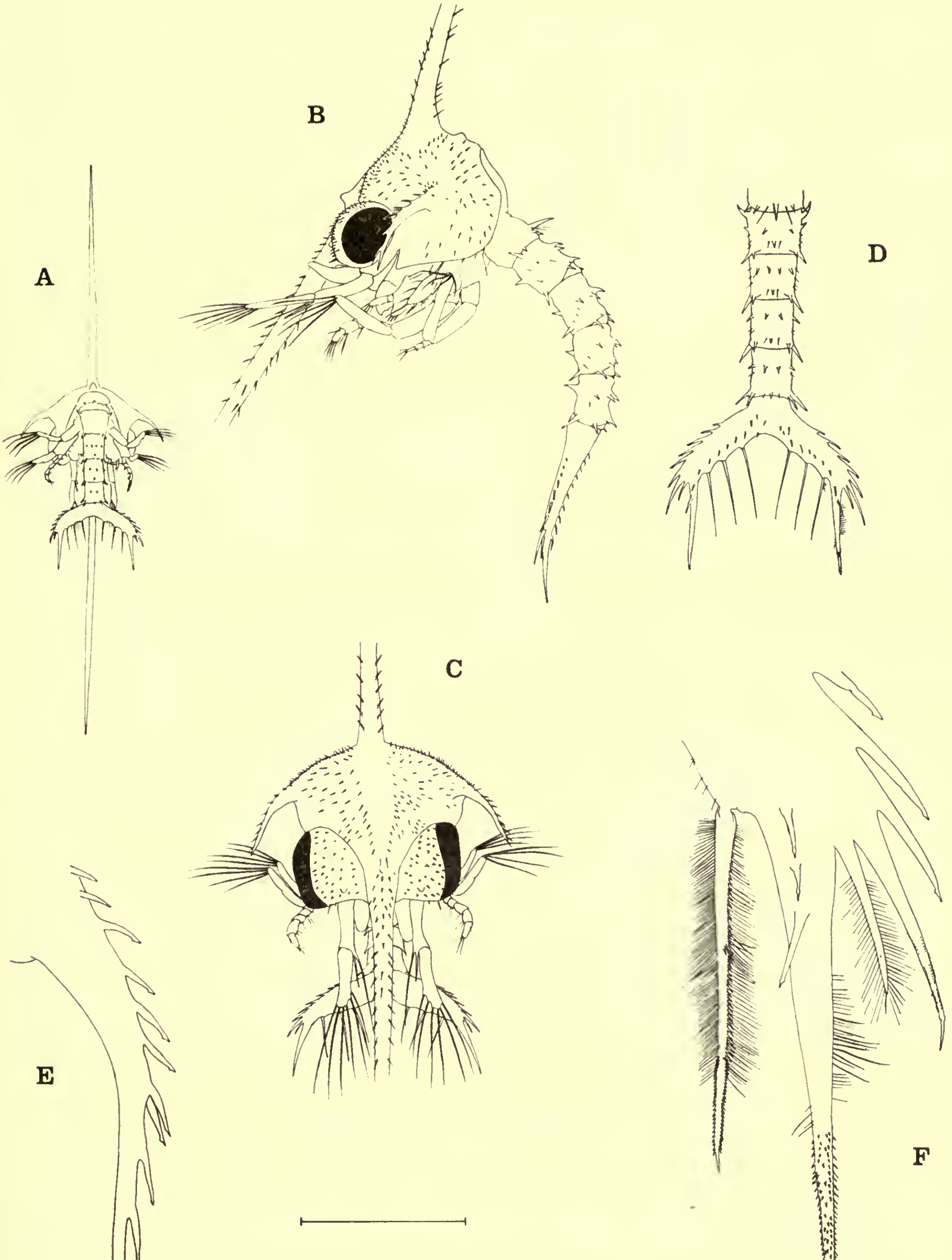

FIG. 1. *Ranina ranina* (L.), stage I zoea. *A*, Posterior view; *B*, lateral view; *C*, frontal view; *D*, dorsal view of abdomen; *E*, enlarged frontal view of lateral carapace spine of left-hand side; *F*, enlarged dorsal view of postero-lateral part of telson. Bar scale represents 2.0 mm for *A*, 1·0 mm for *B*, *C* and *D*, and 0·2 mm for *E* and *F*.

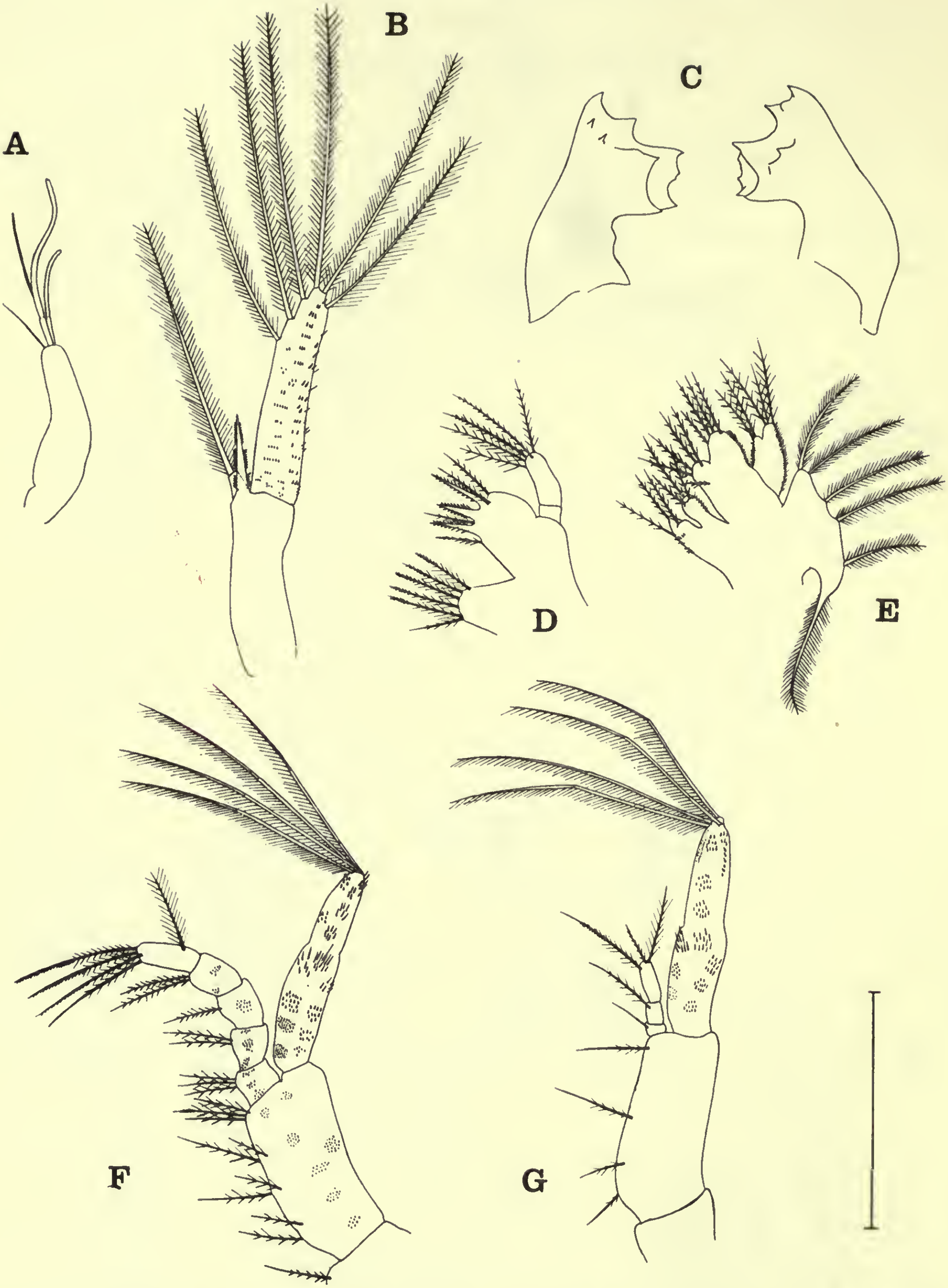

Fig. 2. *Ranina ranina* (L.), stage I zoea. *A*, Antennule; *B*, antenna; *C*, mandibles; *D*, maxillule; *E*, maxilla; *F*, first maxilliped; *G*, second maxilliped. Bar scale represents 0·5 mm.

Ocean raninids (see Table 1) are completely unknown. The I.I.O.E. collections contain only four raninid zoeae and a single megalopa. One of these zoeae apparently belongs to *R. ranina* but the identities of the other specimens are very uncertain.

The British Museum (Natural History) collections contain hatched material of *R. ranina* and I have taken this opportunity to re-illustrate the first zoea of this species.

Ranina ranina (L.)

(figs 1 and 2)

Aikawa, 1941, pp. 117–118, fig. 1.

MATERIAL: (a) About 100 stage 1 zoeae hatched in the Aquarium de Nouméa, New Caledonia, 4. XII. 1956 and presented to the British Museum (Natural History) by Mons. P. Budker of the Museum National d'Histoire Naturelle, Paris (B.M. reg. no. 1958: 7: 4: 2–9).

(b) One stage 1 zoea taken by the *Anton Bruun* at station 18, 07° 41′N: 97° 59′E on 21. III. 1963. This specimen is badly damaged but appears to belong to this species.

SIZE: Tip to tip of the rostral and dorsal carapace spines 6·7–7·7 mm.

REMARKS: Because of the relative abundance of material available it is now possible to illustrate the larvae of this species adequately and a written description is not necessary.

Aikawa's Japanese larvae were somewhat smaller than those from Nouméa and he gives a spine tip to spine tip length of 4·2 mm, but the two sets of larvae show very close agreement in all other features which Aikawa either described or illustrated.

However, Aikawa did not mention the spinules on the antennae and maxillipeds although they were almost certainly present in his material. Williamson (1965) reported such spines on the maxillipeds of first stage zoeae of *Lyreidus tridentatus*, and these features may therefore be widespread within the Raninidae. However, without dissection the appendages of the larvae reported below could not be examined at sufficiently high magnifications in all cases to determine whether the spinules are present or not.

***Raninid larva A; ?Raninoides* sp.**

(fig. 3)

MATERIAL: One specimen in the first zoeal stage. Position 12° 36′N: 80° 40′E; depth 200 m to surface. Date 20. VI. 1964. Vessel I.N.S. *Kistna;* Station 378. I.O.B.C. serial no. 0612.

SIZE: Tip to tip of the rostral and dorsal carapace spines 3·3 mm; Carapace length from between eyes to postero-lateral carapace margin 0·93 mm.

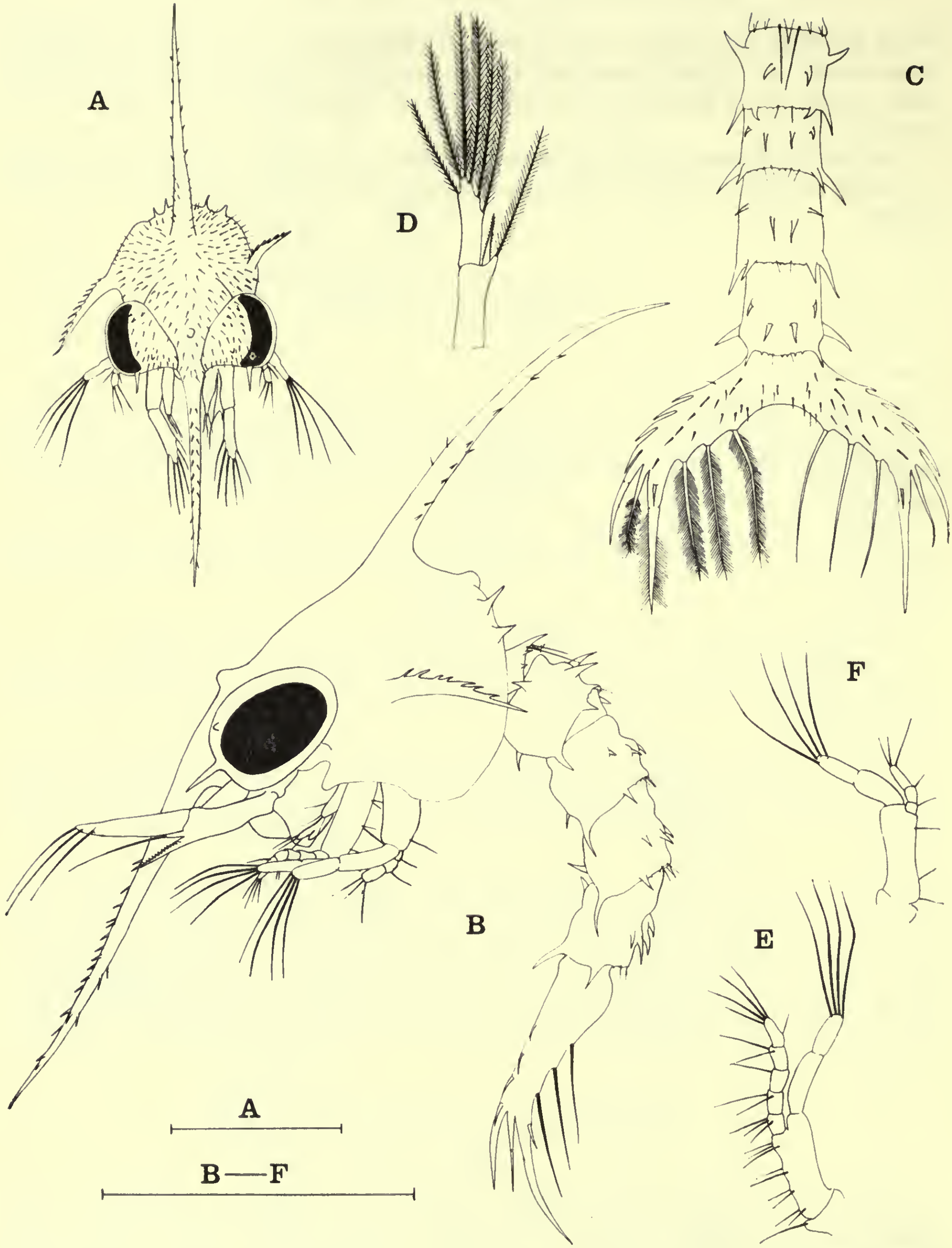

FIG. 3. Raninid larva A, stage I zoea. *A*, Frontal view; *B*, lateral view; *C*, dorsal view of abdomen; *D*, antenna; *E*, first maxilliped; *F*, second maxilliped. The setae covering the surface of the carapace and abdomen are omitted from *B* and *C* for clarity. Bar scales represent 1·0 mm

Description: Carapace with prominent, curved, dorsal and rostral carapace spines, each with a number of subsidiary spines, mainly on the anterior edge of the rostral spine and the posterior edge of the dorsal spine. Lateral spines normally directed downward and forward, roughly parallel to the rostral spine, but that of the left-hand-side displaced backwards (see fig. 3). Each lateral spine with a row of subsidiary spines on the dorsal edge. Anterior dorsal tubercle in the mid-line between eyes; posterior tubercle behind the dorsal spine. A pair of spines on each side of the posterior carapace tubercle, close to the posterior carapace margin. Surface of carapace covered with stiff, almost spine-like bristles (not shown in fig. 3(B)). Eyes sessile, each with a proment spine and a papilla on the stalk.

Abdomen of 5 segments plus the telson. Segment 1 with a large mid-dorsal spine and 2 pairs of smaller dorso-lateral spines. Segments 2–5 each with a single median ventral spine and paired dorsal, dorso-lateral, postero-lateral and postero-ventral spines. The dorso-lateral spines on segment 2 directed forwards like the 'lateral knobs' on this segment in the larvae of the higher Brachyura.

Telson (fig. 3(C)). Each arm of the shallow telson fork with a very large setose spine and 3 postero-median plumed setae. Outside the major spine on each side there are 2 spines, the outer naked, the inner setose. Antero-lateral margin of each telson arm carries 4 smooth spines. There are a number of spinules on the dorsal surface of the telson, and each of the 2 major spines has a subsidiary spine on the dorsal surface close to the base.

Antennule simple and unsegmented, with 2–3 terminal aesthetascs and 1 seta.

Antenna as shown in fig. 3 (D).

Mandibles with incisor and molar processes, but no palp.

Maxillule with an unsegmented endopod with 3 terminal and 1 sub-terminal seta. Endites well developed, but no lateral seta on basis.

Maxilla with 5 setae on the endopod. Scaphognathite with 4 sub-equal plumose setae on the lateral margin and a much longer posterior seta.

Maxillipeds 1 and 2 as shown in fig. 3 (E and F).

None of the more posterior appendages developed.

Remarks: This larva is tentatively attributed to the genus *Raninoides*, on the basis of its close resemblance to that of *Raninoides benedicti*, but it could belong to other Indian Ocean genera whose larvae are unknown. It differs so much from the first zoea of *Lyreidus tridentatus*, particularly in the length of the lateral carapace spines and in the form of the telson, that it is very unlikely to belong to *L. channeri*, the only other member of the genus recorded from the Indian Ocean. The larva also differs from the *Ranina ranina* larvae illustrated above, particularly in being much smaller and possessing eyestalk spines.

Of the raninids recorded from the Indian Ocean this leaves 7 species belonging to the genera *Cosmonotus*, *Notopus*, *Notosceles* and *Raninoides* as possible parents. The larva could belong to any of these genera, but its very close resemblance to the described larvae of *Raninoides benedicti* Rathbun (Knight, 1968) makes another species of this genus a strong possiblity.

The larva differs from the first stage of *R. benedicti* in only a few relatively minor points. Thus, the lateral carapace spines are relatively longer than in *R. benedicti*

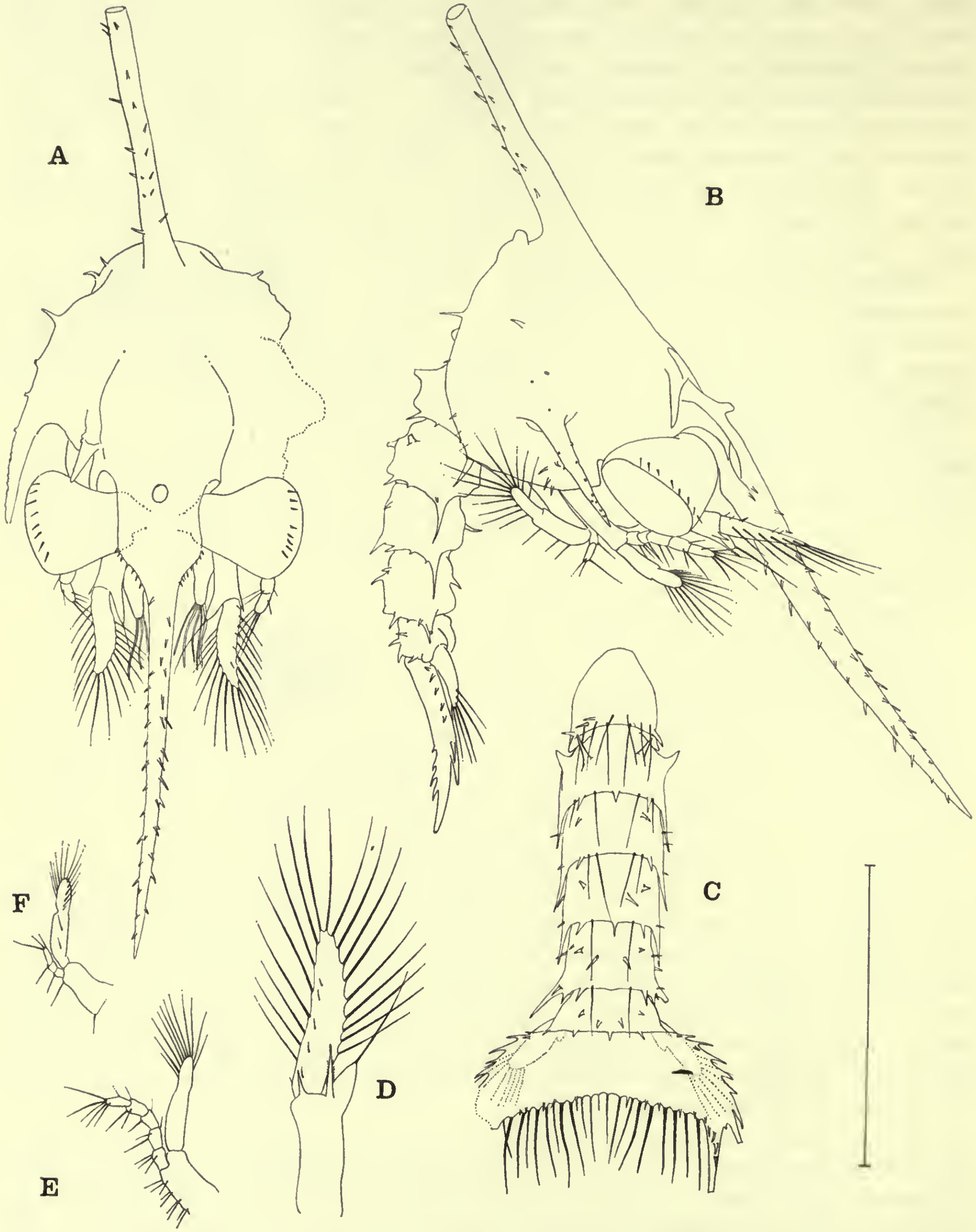

FIG. 4. Raninid larva B, stage III (?) zoea. *A*, Frontal view; *B*, lateral view; *C*, dorsal view of abdomen; *D*, antenna; *E*, first maxilliped; *F*, second maxilliped. Bar scale represents 1·0 mm for *D* and 2·0 mm for the remainder.

and carry more subsidiary spines. There are 4 spines on the antero-lateral margin of each telson fork as opposed to 2 in *R. benedicti*, and there is an extra pair of spines on the posterior carapace margin. All of these differences are probably specific rather than generic.

If the larva does belong to *Raninoides* then the known distributions of the adults (Table 1) indicate that it probably belongs either to *R. personatus* White or to *R. serratifrons* Henderson.

Raninid larva B

(fig. 4)

MATERIAL: One slightly damaged specimen, probably a third zoea. Position 06° 26′N: 49° 46′E; depth 200 m to surface. Date 17. VIII. 1964. Vessel *Argo;* Dodo cruise; Station 37. I.O.B.C. serial no. 0374.

SIZE: Carapace length from between the eyes to posterior carapace margin 1·83 mm; Abdomen length 2·71 mm; no spine tip to spine tip measurement can be given because the dorsal spine is broken.

DESCRIPTION: Carapace with long dorsal and rostral spines, and curved, forwardly directed lateral spines, each with a number of subsidiary spines. Anterior and posterior blunt dorsal tubercles in the mid-line. A supra-ocular spine present on the right-hand-side; the left-hand-side is damaged, but does not appear to have possessed a spine in this position. A number of spines on the carapace surface beneath the insertion of each lateral spine and on the slightly raised ridge between the dorsal and lateral spines. A series of spines on each postero-lateral carapace margin decreasing in size ventrally. Eyes free, with the stalks carrying many setae but no sign of papillae or spines. Whole surface of carapace covered with short setae (not shown in the illustrations).

Abdomen of 6 segments plus the telson. Segments 2–5 with long, acute spines on the postero-lateral corners. Segment 2 with forwardly directed lateral processes and segments 4 and 5 each with a median ventral spine. All abdominal segments with a number of other spines on the dorsal and lateral surfaces and also on the posterior margins; segments 1–5 have long setae on the posterior margins (fig. 4(C)).

Telson (fig. 4(C)) a broad flat plate, about 4 times as broad as its length in the mid-line. Posterior margin on the right-hand-side carries a large, fused spine, presumably representing the 4th telson process. Outside this large spine there are a very small and 2 larger fused spines which probably represent the first 3 telson processes, although the outer one is not clearly distinguishable from the series of spines on the antero-lateral telson margin. Postero-lateral region of the telson on the left-hand-side is damaged beyond the base of the main fused spine. Posterior margin with 21 articulated processes between the major spines. A series of small spines on the dorsal surface, close to the posterior margin, extends onto the main telson spines. Dorsal surface of telson and abdominal segments with many small setae.

Antennule simple and unsegmented, with 3–4 terminal aesthetascs and a single seta.

Antenna (fig. 4(D)) with 19–20 marginal setae on the scale and a series of small bristles on both the upper and lower surfaces. Endopod less than 1/3 length of

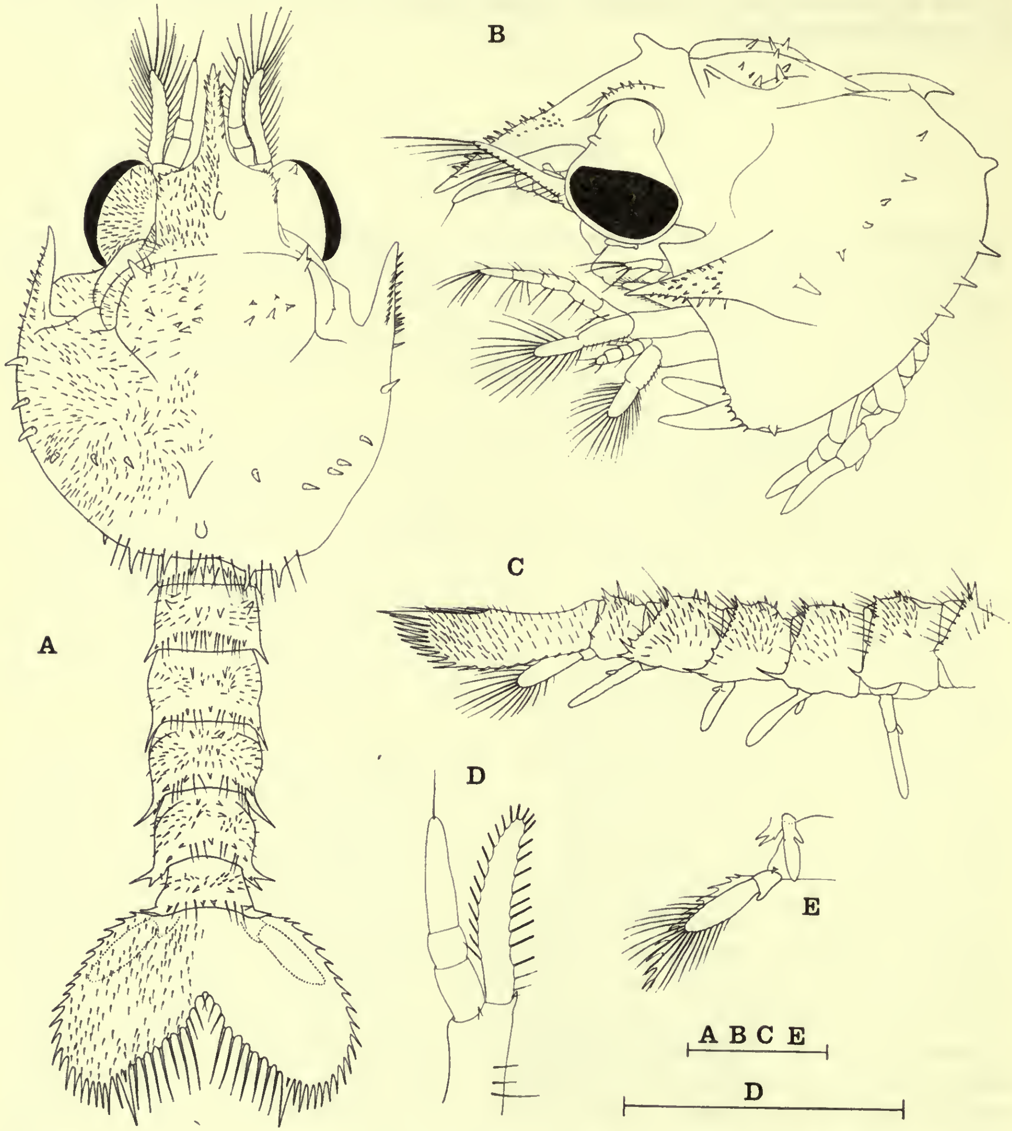

Fig. 5. Raninid larva C, terminal zoea. *A*, Dorsal view; *B*, lateral view of thorax; *C*, lateral view of abdomen; *D*, antenna; *E*, ventral view of last pleopod and uropod on the right-hand-side. The small surface setae have been omitted partly from *A* and wholly from *B*. Bar scales represent 1·0 mm.

scale, fused to basis and armed with a single terminal seta. Basis with spinous process about 1/3 length of scale, and a second prominent spine at the base of the scale.

Manbidle with no palp.

Maxillule with an unsegmented endopod armed with 4 setae. A single seta on the lateral margin of the basis below the endopod.

Maxillipeds 1 and 2 as shown in fig. 4(E and F). Exopod of maxilliped 1 with 11 or 12 natatory setae, that of maxilliped 2 with 13 setae on the distal half and 3 on the proximal half.

Maxilliped 3 and the more posterior thoracic appendages present as unarmed, unsegmented buds.

No pleopods present but the uropods have well developed exopods carrying 6 or 7 marginal setae. Endopods represented by very small unarmed buds not separated from the protopods.

REMARKS: From the known development of *Lyreidus tridentatus* and *Raninoides benedicti* it is clear that the determination of the zoeal stage in raninid larvae is not as simple as it is, for example, in the higher Brachyura. However, from the presence in the above larva of well developed uropods but the absence of pleopods, and also the degree of development of the antennules, antennae and maxillipeds, it appears to be at about the mid-point of the zoeal series, perhaps the third or fourth of a total of about 6 zoeal stages.

Identification of this larva is also difficult. The differences between it and the known larvae of *Lyreidus* and *Raninoides* suggest that it belongs to a genus other than these. The changes which would be necessary to transform the first zoea of *Ranina ranina* into this larva, particularly in the armature of the carapace and the form of the telson, are greater than those ocurring during the development of *L. tridentatus* and *R. benedicti*, indicating that it does not belong to *R. ranina* either. This leaves the parentage still very uncertain, but probably among the genera *Cosmonotus*, *Notopus* and *Notosceles*.

Raninid larva C

(fig. 5)

MATERIAL: One specimen in the last zoeal stage. Position 09° 34′N: 75° 16′E; depth 200 m to surface. Date 10. II. 1965. Vessel *Meteor;* Station 187. I.O.B.C. serial no. 0145.

SIZE: Tip of rostral spine to tip of dorsal spine 3·8 mm; tip of rostral spine to posterior median carapace margin 3·9 mm; total length (tip of rostral spine to base of telson fork) 6·6 mm.

DESCRIPTION: Carapace with prominent forwardly directed rostral and paired lateral spines; subsidiary spines on the dorsal surface of the rostrum and on the outer surfaces of the laterals. Dorsal spine small, curving posteriorly. Blunt anterior and posterior carapace tubercles in the mid-line. Rostrum widens between the eyes to a front carrying a series of spines on each antero-lateral angle. A pair of bulbous lobes behind the eyes each carrying a prominent spine antero-laterally and a number of smaller spines dorsally. A curving row of 6 spines on each side of the carapace between the bases of the lateral and dorsal spines. A parallel row of 4 spines close to the postero-lateral carapace margin. Each postero-ventral corner of the carapace with a single spine and a series of denticles. A prominent papilla on each eyestalk.

Abdomen (fig. 5(A and C)) of 6 segments plus the telson. First segment with a raised transverse ridge armed with a row of long plumose setae and with 3 spines close to the mid-line. Segments 2–5 all basically similar, having each postero-lateral margin produced into a long, slightly curved spine. A somewhat variable number of other spines on each segment, but a basic pattern of 4 on the dorsal surface anteriorly, and a series of 5 on the postero-dorsal margin. Segment 5 with additional spines, including a prominent one at each postero-lateral corner. Segment 6 with only 2 dorsal spines, but 6 spines on the posterior margin, the outer pair in dorsal view looking like the postero-lateral spines of the more anterior segments.

Telson (fig. 5(A)) a broad, bilobed plate. Each antero- and postero-lateral margin with a series of fused spines increasing in size gradually posteriorly, but ending in a much larger spine with a small spine basally on the dorsal surface. Posterior telson margin with 10 pairs of articulated processes between the telson forks, inner 3 pairs much smaller than the others and probably added at the most recent moult.

The whole of the dorsal surface of the carapace, abdomen and telson covered with short, close-set setae.

Antennule with an unsegmented peduncle, swollen basally and with an obvious statocyst. Endopod unarmed and not separated from the peduncle. Flagellum with 3 groups of about 3, 3, and 4 aesthetascs.

Antenna (fig. 5(D)) with 26–28 marginal setae on the scale. Endopod 3-segmented, about as long as scale and with a single terminal seta. Protopod with 2 spines and 3 setae.

Mandible with an unarmed, unsegmented palp.

Maxillule with 2-segmented endopod carrying 5 setae on the distal segment and a single seta on the proximal segment. Lateral margin of basis with a single seta.

Maxilla with more than 70 marginal setae on the scaphognathite. Unsegmented endopod with 6 terminal, 1 medial and 4 lateral setae.

Maxilliped 1 with 2-lobed epipod. Basipod with 15 setae on medial margin. The 5 segments of the endopod carry 3, 2, 2, 4 and 6 setae respectively on the medial margins. The lateral margins of segments 2 and 5 (terminal) each with a single fine seta, those of segments 3 and 4 each with 2 fine setae. Exopod 2-segmented; proximal segment with 8 setae along posterior edge, distal segment with 15 or 17 setae around whole margin.

Maxilliped 2 with simple epipod. Basipod with 4 setae on medial margin and 2 on posterior surface at the base of the endopod and exopod. Endopod on one side of 4 segments with 2, 1, 2 and 3 inner setae respectively. On the other side the long penultimate segment is sub-divided, the proximal part being unarmed. Terminal and sub-terminal segments each with a very fine lateral seta. Exopod 2-segmented;

proximal segment with 6 or 7 setae along posterior edge, distal segment with 21 marginal setae.

Maxilliped 3 with endopod indistinctly divided into 4 segments of which the terminal and sub-terminal each carry a short seta. Exopod short, simple and unarmed.

Pereiopods all present and indistinctly segmented, the first pair chelate.

Pleopods on abdominal segments 2–5 well developed but unsegmented, with small endopods and larger exopods (fig. 5 (C and E)). Exopods and endopods unarmed, but with somewhat serrate margins indicating that they would probably become setose at the next moult. Uropods with exopods separated from protopods and carrying 20–21 plumose setae. Endopods represented by small buds and not separated from the protopods (fig. 5(E)).

REMARKS: Of the raninid larvae previously described, this zoea most closely resembles *Lithozoea serrulata* described by Aikawa (1933). The two larvae share a number of common features including the broad, plate-like telson, forwardly directed carapace spines, spine rows on the posterior carapace margin and on the side of the carapace between the lateral spines and the dorsal spine, and relatively short rostral and dorsal spines. The main differences between the larvae are the development of the anterior carapace tubercle into a bifurcated spine and the presence of lateral carapace keels in *Lithozoea*, the presence of a mandibular palp in the Indian Ocean larva and 4 ot 5 segments in the endopod of the second maxilliped in this larva compared with only 3 in *Lithozoea*.

Williamson (1965) pointed out that *Lithozoea serrulata* possesses a number of homolid characters, particularly in the carapace spines and keels. Although raninid larva *C* is somewhat less homolid in these respects than *Lithozoea*, it does resemble late homolid zoeae in having more than 3 segments in the endopod of the second maxilliped. No brachygnathan larvae have more than 3 segments in this endopod, and the only previously described raninid larva which may have more than 3 is *Acanthocaris* described by Claus (1876 and 1885) (see Williamson, 1965, p. 388), which also shows some homolid features in its carapace.

Little can be said about the identity of this Indian Ocean larva. As with the previous larva, comparison with published larval descriptions readily excludes it from the genera *Lyreidus*, *Ranina* and *Raninoides*. This still leaves as possible parents the genera *Notopus*, *Cosmonotus* and *Notosceles*, although adult *Notosceles* are so similar to *Raninoides* that they must surely have similar larvae. The similarities between the Indian Ocean larva and Aikawa's *Lithozoea serrulata* suggest that they belong to the same genus. If this is so, the Indian Ocean larva may belong to *Notopus dorsipes* (Fabr.) since, of the three genera deduced as possible parents, *Notopus* is the only one with different species recorded in Indian and Japanese waters. *N. dorsipes* is the only species known from the Indian Ocean, having been recorded by Alcock (1896) from off the Malabar coast, relatively close to where raninid larva *C* was collected, but two other species, *N. ovalis* Henderson and *N. misakiensis* Sakai are also recorded from Japan (Sakai, 1937). *Lithozoea serrulata* perhaps belongs to one of these species.

***Raninid larva D; ?Raninoides* sp.**

(figs 6 and 7)

Material: One megalopa. Position 10° 36′N: 95° 39′E; depth 125 to 250 m. Date 25. III. 1963. Vessel *Anton Bruun;* cruise 1; Station 24 S.O.S.C. Acc. no. 3.

Size: Carapace length from tip of rostrum to posterior carapace margin 3·6 mm; Maximum carapace width 1·9 mm.

Description: The megalopa is fully illustrated in figs 6 and 7. It is very similar to the megalopa of *Raninoides benedicti* as described by Knight (1968) and therefore only the main differences between the two larvae will be mentioned here.

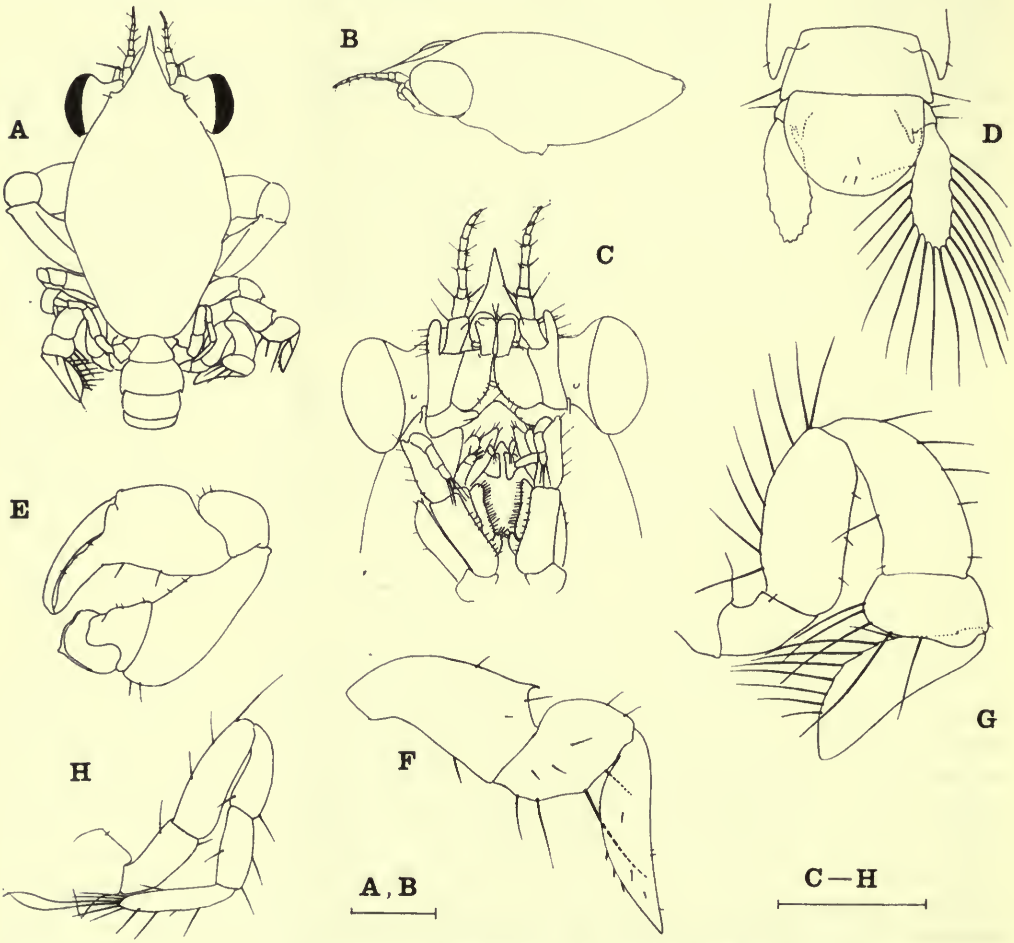

Fig. 6. Raninid larva D; ?*Raninoides* megalopa. *A*, Dorsal view; *B*, lateral view of carapace; *C*, ventral view of anterior part of thorax; *D*, dorsal view of telson; *E*, cheliped, left-hand-side, ventral view; *F*, *G*, and *H*, third, fourth and fifth pereiopods respectively of the right-hand-side, dorsal views. Bar scales represent 1·0 mm for *A*, *B*, *C* and *E*, and 0·5 mm for *D*, *F*, *G* and *H*.

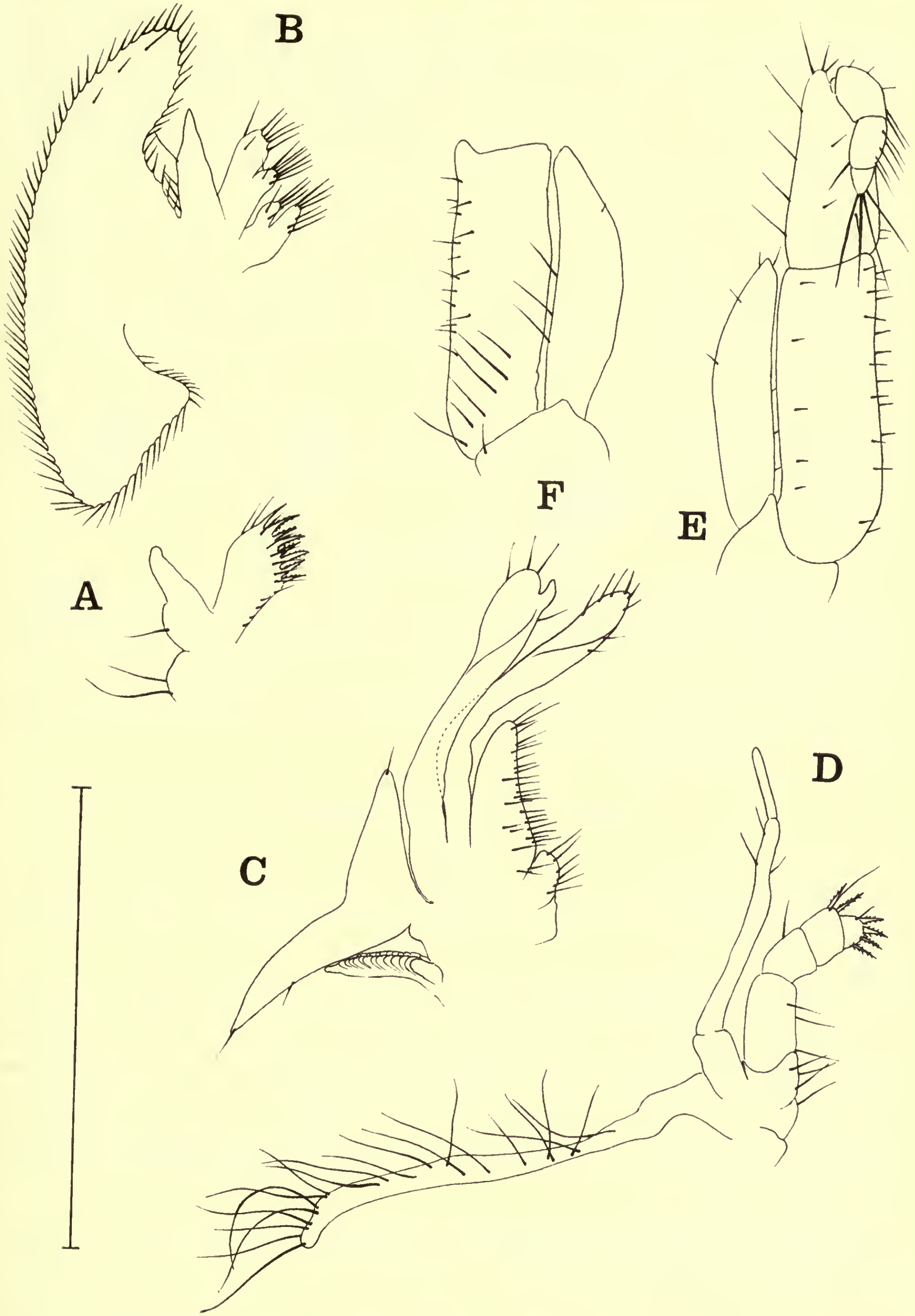

FIG. 7. Raninid larva D; ?*Raninoides* megalopa. *A*, Maxillule; *B*, maxilla; *C*, *D* and *E*, first, second and third maxillipeds in ventral view; *F*, ischium and exopod of third maxilliped in dorsal view. Bar scale represents 1·0 mm.

The carapace is slightly narrower posteriorly than is that of *R. benedicti.* The eyestalk papillae are placed postero-ventrally rather than antero-dorsally as in *R. benedicti.* The large spine between the bases of the chelipeds in *R. benedicti* is absent. The Indian Ocean megalopa has no podobranch on the second maxilliped, while the ischium of the third maxilliped (fig. 7(E and F)) is relatively longer than in *R. benedicti* and has no teeth on the inner margin.

The chelipeds and the second and third legs in *R. benedicti* each have a prominent spine on the ventral margin of the merus; the Indian Ocean megalopa lacks these spines but has a spine on the dorsal margin of the carpus of legs two and three. (These two legs are very similar, and therefore only leg three is illustrated in fig. 6.) The fourth and fifth legs are very similar in shape in the two larvae, but the fourth leg in the Indian Ocean specimen carries many more setae and the dactyl is less acutely pointed than in *R. benedicti.*

REMARKS: The similarity between this larva and the known megalopa of *Raninoides benedicti* indicates that it belongs to the same genus. From the locality of capture of the larva and the known distributions of the adults, *Raninoides hendersoni* Chopra and *R. serratifrons* Henderson are equally likely to be the parent.

Family **HOMOLIDAE**

Plankton-caught larvae of the Homolidae present very much the same problems of identification as do those of the Raninidae, since larvae have been hatched from only four species and the complete larval development is known for only one of these (see Williamson, 1965 and Rice and Provenzano, 1970).

The I.I.O.E. collections contain only two homolid zoeae, neither of them agreeing with any previously described larvae.

***Homolid larva A ?Homola* sp.**

(fig. 8)

MATERIAL: One specimen, probably a second zoea. Position 11° 49′S: 49° 23′E. Date 21. VII. 1964. Vessel *R.R.S. Discovery;* Station 5508. I.O.B.C. serial no. 1517.

SIZE: Carapace length from tip of rostrum to posterior margin in mid-line 1·4 mm; Total length from tip of rostrum to posterior margin of telson in mid-line 2·5 mm.

DESCRIPTION: The main features of the morphology of this larva are adequately shown in the illustrations. This description will therefore be restricted to those features which are not illustrated but which can be seen without dissection.

Antennule 2-segmented. Distal segment with 3 or 4 aesthetascs and setae; proximal segment with a long median seta, representing the inner flagellum, and a row of 3 short setae.

Mandibles without palps.

Maxilla with about 18 marginal setae on the scaphognathite.

Maxilliped 1 as shown in fig. 8 (D).

Maxilliped 2 with the 4 segments of the endopod carrying 1, 1, 2 and 5 setae respectively, one seta on the terminal segment being laterally placed. Basis with 5 medial setae and the exopod with 7 natatory setae.

Maxilliped 3 with an unsegmented endopod carrying a single terminal seta. Exopod with 7 setae.

Posterior thoracic appendages represented by unarmed, unsegmented buds.

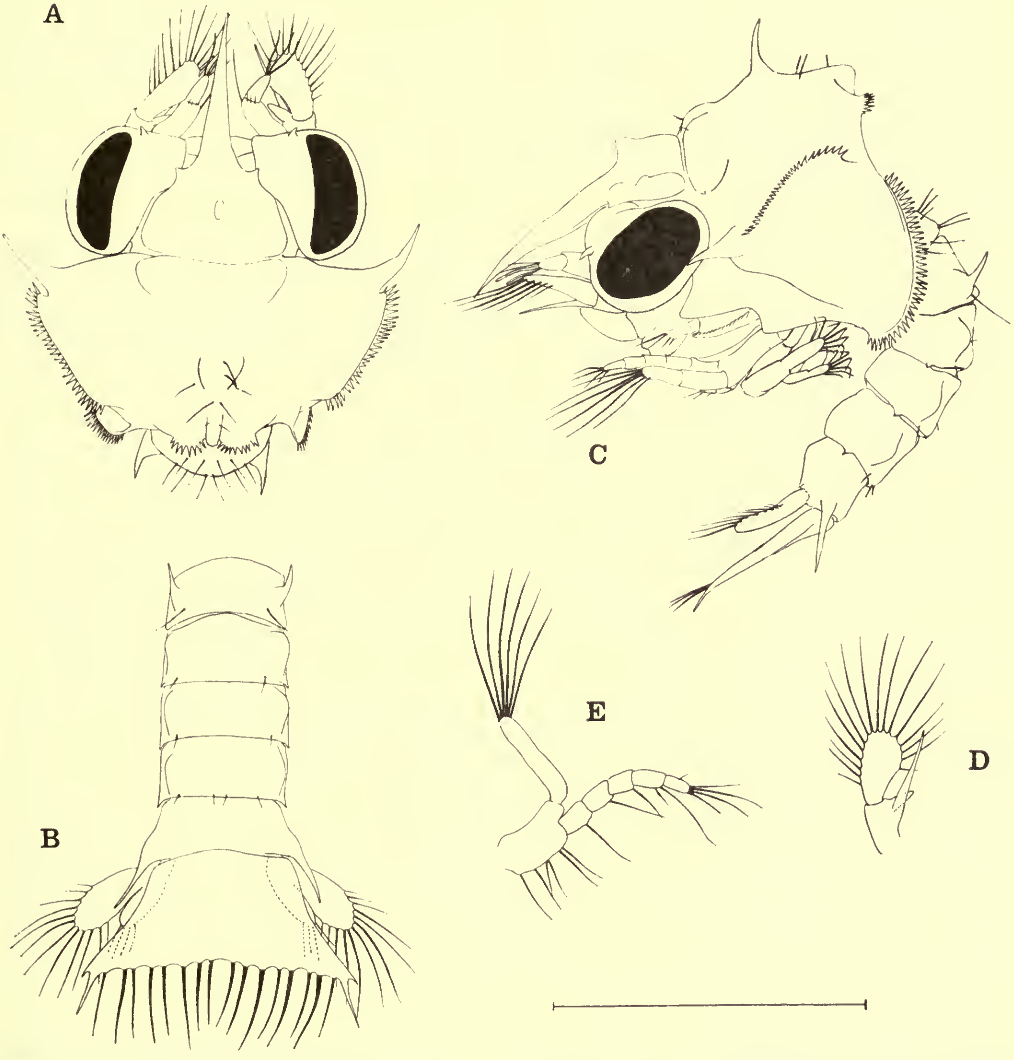

FIG. 8. Homolid larva A, stage II zoea. *A*, Dorsal view of carapace; B, dorsal view of abdomen; C, lateral view; D, antenna; E, first maxilliped. Bar scale represents 1·0 mm.

REMARKS: In general form this larva is very similar to the larvae of *Homola barbata* (Fabr.) described from Florida by Rice and Provenzano (1970), and also to the series of larvae taken in the plankton off South Africa and attributed to a species of *Homola* by Rice and von Levetzow (1967). However, the present specimen differs from these previously described forms in several important respects.

The supra-ocular spines and the anterior and posterior carapace tubercles, which are very prominent in the Florida and South African larvae, are much reduced in the Indian Ocean specimen. This larva also has the anterior end of the dorsal tooth row on the carapace less protruberant than in the other larvae, and less likely to be replaced by a spine in the later stages.

The dorsal spines on abdominal segments 2–5 in the Florida and South African larvae are entirely lacking in this specimen and, except for the second segment, the dorso-lateral spines are reduced to blunt protruberances. The Indian Ocean larva also lacks spines on the dorsal surface of the telson.

Finally, in its degree of development this larva does not agree precisely with any stage in either of the previously described series, falling between the second and third stage in both cases.

The absence of dorsal telson spines in two ?*Homola* larvae from off south-east Africa described by Boas (1880) suggested to Rice and von Levetzow that these larvae were specifically distinct from their own South African material. From the known distributions of the adults these authors suggested that Boas's larvae might represent *Homola orientalis* Henderson, while their own material belonged to the eastern Atlantic and South African form of *H. barbata*.

The larvae described here also lacks dorsal telson spines, like Boas's larvae, but differs from them in having reduced supra-ocular spines. Boas's larvae also have a pair of dorso-lateral carapace spines, presumably developed from the anterior end of the dorsal carapace tooth row of an earlier stage; as noted above, such spines are unlikely to be developed in a later stage of the I.I.O.E. larva. If these differences are specific, then there is either a third, unsuspected, species of *Homola* in the south-western Indian Ocean, or else at least some of the larvae attributed to *Homola* in fact belong to a different genus.

Knowledge of generic differences between homolid larvae is restricted to a comparison of hatched larvae of *Homola barbata* (Fabr.) (Rice and Provenzano, 1970), *Paromola japonica* Parisi and *Latreillia phalangium* de Haan (Aikawa, 1937) and *Latreillia australiensis* Henderson (Williamson, 1965). Williamson noted that the homolid larvae described up to that time (1965) fell into two groups, one of which, including the hatched larvae of *Latreillia* and *Paromola*, differed from the second group in having neither dorsal nor antero-lateral carapace spines and no dorsal spines on the abdomen. Williamson suggested that these groups probably did not represent taxonomic groupings within the family and that intermediate forms would probably be found as more homolid larvae were described.

The larva described here agrees most closely with the second of these larval groups, which includes not only the larvae described by Rice and von Levetzow (1967), Rice and Provenzano (1970) and Boas (1880), but also Gurney's (1924) Dromiacean species I and specimens attributed to the genus *Homola* by Cano (1893), Thiele (1905), Pike and Williamson (1960) and Rice (1964). However, it differs from all of these forms in the absence of mid-dorsal spines on the abdominal segments and is therefore intermediate between Williamson's two groups. Considering the great similarity between the known larvae of *Latreillia* and *Paromola*, generic differences between homolid larvae seem to be very slight so that this larva may, indeed, belong to a genus other than *Homola*.

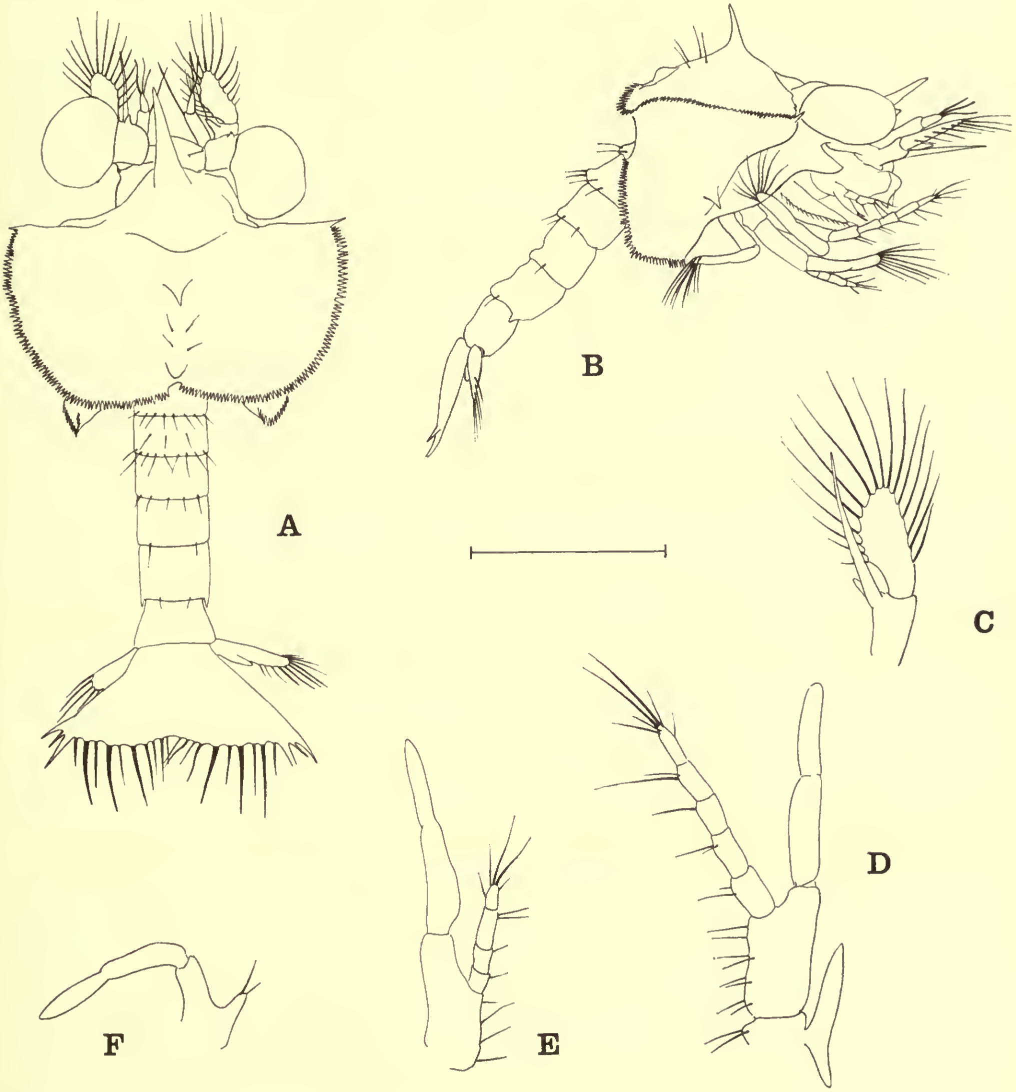

FIG. 9. Homolid larva B, stage III zoea. *A*, Dorsal view; *B*, lateral view; *C*, antenna; *D*, *E* and *F*, first, second and third maxillipeds. Bar scale represents 1·0 mm for *A* and *B*, and 0·5 mm for *C*, *D*, *E* and *F*.

Homolid larva B

(fig. 9)

Material: One specimen, probably a third zoea. Position 16° 31′N: 54° 08′E. Date 30. VI. 1963. Vessel *R.R.S. Discovery:* Station 5026. I.O.B.C. serial no. 0811.

Size: Carapace length from tip of rostrum to posterior margin in mid-line 1·5 mm. Total length from tip of rostrum to posterior margin of telson in mid-line 3·3 mm.

Description: Carapace with a forwardly directed and somewhat upturned rostrum. Prominent mid-dorsal spine and smaller posterior carapace tubercle; no anterior tubercle. Dorsal tooth row of 70–80 teeth on each side, extending from middle of posterior margin to behind the eye and ending in a rather longer and stouter tooth. Postero-ventral tooth row of 50–60 sub-equal teeth. A prominent ventro-lateral spine on each side of the carapace above the base of the third maxilliped. Prominent eyestalk papillae.

Abdomen of 6 segments and telson. Segment 2 with slight dorsal transverse ridge and segment 5 with small postero-lateral processes; otherwise all abdominal segments simple and unarmed apart from some setae close to posterior margins.

Telson a broad, triangular plate, with 3 fused spines at each postero-lateral angle and 10 pairs of processes articulated to posterior margin. Uropods with protopods not separated from endopods and exopods. Endopods unarmed, exopods with 9–11 marginal setae.

Antennule 2-segmented, proximal segment with a single long plumose seta representing ventral flagellum, distal segment with 2 terminal aesthetascs and 2 setae.

Antenna (fig. 9(C)) with 16 marginal setae on scale, spinous process about 1·5 times length of scale, endopod unarmed and less than half length of scale.

Mandibles without palps.

Maxillule with 5 setae on distal segment of endopod and a single seta on proximal segment; no lateral seta on basis.

Maxilla with about 40 setae on scaphognathite.

Maxillipeds as illustrated in figs 9 (D, E, and F); exopods of each with 8 natatory setae.

Posterior thoracic appendages present as unarmed, unsegmented buds.

Remarks: Like the preceding larva, this specimen is intermediate between the two homolid larval groups noted by Williamson. Thus, although it possesses the prominent dorsal carapace spine of the '*Homola*' group, it lacks the dorsal abdominal spines typical of most of these larvae. It is even less *Homola*-like than the larva described above since it also lacks any suggestion of supra-ocular spines, it has very small antero-laterals (if, indeed, the enlarged teeth at the anterior end of the dorsal carapace tooth rows represent these), and it has no dorso-lateral projections on the abdominal segments. The combination of characters is so different in this larva from that in any previously described zoea that its identity cannot be established at present.

DISCUSSION

The small collection of raninid and homolid larvae reported here tends to confirm Williamson's (1965) conclusions that the similarities between the two groups are consistent with both families being fairly close to a pre-brachyuran stock, the raninids being considerably more 'brachyuran' than the homolids.

Perhaps the most interesting larva in the collection is that described as raninid larva *C* which, like Aikawa's *Lithozoea serrulata*, is intermediate in many features between the homolids and the typical raninid larvae. Williamson noted that *L. serrulata* represents a possible intermediate step in the simplification of the rather complex carapace armature of the homolids towards the dorsal, rostral and lateral spines of the carapace in typical raninid and brachygnathan zoeae. Raninid larva *C* seems to be a further step in this direction, since the homolid denticulate carapace-folds, still present in *L. serrulata*, are represented only by a series of short spines in this larva. The relationship of the lateral carapace spines to the carapace folds and denticle rows in raninid larva *C* and *L. serrulata* indicate that the lateral spines in the raninids, and presumably also in the higher Brachyura, are homologous with either the antero-lateral spines in the homolids or, more probably, with the spines developed from the anterior ends of the dorsal denticle rows.

The bilobed, plate-like telsons of *L. serrulata* and raninid larva *C* also conveniently bridge the gap between the rather anomuran broad triangular telsons of late homolid zoeae and the forked telsons of the zoeae of *Ranina*, *Raninoides* and *Lyreidus*, which are more similar to those of typical brachyuran zoeae.

It would be interesting to know if these seemingly primitive raninid larvae belong to species with similarly primitive adults, but such information can come only from the rearing work which is much needed in both the Homolidae and the Raninidae.

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Pp. 25–49; 3 *Plates*

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By J. E. HILL & P. MORRIS

INTRODUCTION

THERE has been hitherto no great concentration on the bat fauna of Ethiopia by collectors and many records are of one or two specimens sporadically obtained. For this reason the present collection is of particular interest, and is of especial value for the wide representation of the bats of western Ethiopia, hitherto largely unrecorded. This paper is an account of the bats collected by the Great Abbai Expedition including taxonomic notes, and revisions where appropriate, together with what little ecological information is available.

The principal aim of the Expedition was to carry out a survey of the Blue Nile (= Great Abbai) Gorge. The organization of the Expedition and its main activities are described by Blashford Snell (1970). The bat collections were made mainly in the Gorge itself at river level at various "Forward Bases" west of Shafartak Bridge, or in the Awash National Park, with some additional specimens being obtained elsewhere, notably in the highlands at Ghimbi.

The Nile Gorge is a unique habitat, mostly uninhabited with dense scrub covering the steep rocky hillsides. There is a spectacular seasonal change here; during the dry season the river almost ceases to flow and the Gorge becomes exceedingly arid with only a narrow fringe of tall trees beside the river retaining their leaves. At this time survival must be a serious problem for many animals, Megachiroptera especially being unlikely to find any succulent fruits and presumably migrating elsewhere. By contrast insects appear to be especially abundant in the dry season, according to previous explorers, so that the Microchiroptera may well remain throughout the year, though the fierce heat and lack of shelter must cause problems. The Expedition's visit to the Nile Gorge came towards the end of the wet season, when the atmosphere was warm and humid; the lush green vegetation seemed to provide an ideal habitat for a wide range of animals and gave no indication of just how inhospitable the habitat is during at least one third of the year.

The Awash National Park is chiefly an open dusty area of grassland, thorn scrub and volcanic rubble. An important geological feature, so far as bats are concerned, is the occurrence of "lava blister caves". These are evidently formed by gas bubbles in flowing lava and appear on the ground as low, rounded hillocks standing up prominently in an otherwise flat area. These mounds are hollow inside and some have perforated so allowing access to the interior. They represent the only cool, shady retreats in an otherwise open, arid landscape and consequently house many bats. Two of the blisters had openings only at their highest points. These had functioned as pitfall traps and also perhaps as carnivore dens, and the floors of both were littered with mammal bones which included the remains of five bat species.

Live bats were collected either by shooting (with ·22 or ·410 guns loaded with dust shot) or with mist nets. Fixed nets, supported on poles, trees or convenient rocks were avoided by flying bats, and only proved useful when set at a roost entrance whence the bats could be driven into the net. For catching bats as they flew low hawking for food a hand held net was employed. A small net (about 1 m × 1·5 m), supported between two fibreglass rods was held close to the ground and flicked sharply upwards to catch the bat as it flew past. The method requires both patience and a certain amount of practice and was used with particular success by Dr. D. W. Yalden to catch most of the free-flying bats obtained. Specimens taken this way come in ones and twos and contrast with sizeable batches of bats taken at roosts. Because roosting bats are easier to get in quantity, they figure prominently in this collection, though their numbers here are not necessarily a reflection of true abundance in the field. Netted bats are often of greater interest purely because they are difficult to catch, particularly if they do not form communal roosts; they are therefore poorly represented in collections.

The specimens obtained were either preserved whole in formalin, supported on card so as to keep the wings well displayed or they were prepared as a skull and dry card-mounted skin. The collections of the British Museum (Natural History) contain also a small number of specimens representing species previously not recorded from Ethiopia and notes on these are included in this report. Such specimens are denoted by their registration numbers, as is a single specimen from French Somaliland (Territory Afars and Issas) which constitutes a new record for that country and is included in this paper.

The majority of bat specimens collected by the Great Abbai Expedition are now in the collections of the British Museum (Natural History), but where numbers have permitted this to be done, duplicate examples have been sent to the Museum at Haile Selassie I University, Addis Ababa.

In the present paper, the altitudes and co-ordinates used have been taken from the best available maps, the 1 = 1,000,000 series. For convenience, clarity and ease of future reference these have been adhered to, even though investigations in the field showed the maps to be inaccurate in places. Part of the Nile forms the boundary between the provinces of Gojjam and Wollega; specimens obtained at the riverside have not been specifically assigned to either. Times given are 'local time', and as a rough rule the period 19.00 hrs–06.00 hrs is passed in darkness. Linear measurements of specimens are in millimetres: the minimum, maximum and mean (in parentheses) are given for series.

It is hoped that a future paper will give detailed background information on the ecology of the areas visited by the Expedition, meanwhile the brief survey above and the "collection and field notes" for the various species below have been prepared by one of us (P.M.) from actual field data; determinations and taxonomic investigations are the work of J.E.H. We would like to express our thanks to various members of the Great Abbai Expedition for the hard work and long hours spent in pursuit of bats under trying conditions. The efforts in the field of Drs. D. W. Yalden, M. J. Largen and Mr. H. King are particularly acknowledged.

SYSTEMATIC SECTION

Epomophorus anurus (Heuglin, 1864)

SPECIMENS. 2 young adult females. Temporary base, Mouth of Azir River, Blue Nile Gorge, 10° 29′ N, 36° 25′ E, alt. 1,000 m. 21 August 1968.

TAXONOMIC NOTES. These young adult specimens agree closely in palatal proportions with those given by Anderson (1912 : 533) for females of *E. anurus*. Kock (1969 : 18) considers *anurus* a subspecies of *E. labiatus*.

COLLECTION AND FIELD NOTES. A small group of fruit bats was located, flying about under the big trees lining the river; the bats were particularly concentrated around some large fig trees which bore plenty of ripe fruit. The remains of many chewed figs littered the ground below. The bats were seen at about 21.30 hours, and were immediately recognized as Megachiroptera by the distinctive way in which their eyes appeared large and red as they reflected the light from torch beams. Three specimens were obtained using dust shot. It was interesting to note a form of communal behaviour; the bats had been following each other in threes and fours through gaps in the foliage, and when each specimen was shot, the others changed course and flew low and close to investigate the victim. The bats showed particular concern in response to the cries of a wounded individual. No other instances of group behaviour of this nature were observed with any of the other bats obtained. This communal response is all the more remarkable if the group really did include two species (see below). All three specimens of *Epomophorus* were females, so it may be that the group was part of a nursing colony whose individuals would perhaps have a stronger attachment to others of their species than normal.

Epomophorus sp.

SPECIMEN. 1 young adult female. Temporary Base, mouth of Azir River, Blue Nile Gorge, 10° 29′ N, 36° 25′ E, alt. 1,000 m. 21 August 1968.

TAXONOMIC NOTES. It seems likely that this young adult specimen is referable to *E. gambianus*, a species recorded from southern Ethiopia by Andersen (1912 : 540). Although from the proportions of the palate it could be referred to *E. crypturus* as defined by that author, this species is known so far only from localities in and south of the southern Congo and southern Tanzania, and, furthermore, in several of its dimensions this specimen exceeds the greatest size as yet recorded for *E. crypturus*. Measurements: length of forearm 77·9; greatest length of skull 50·3; condylobasal length 50·0; condylocanine length 48·3; median palatal length 27·7; post palatal length 12·3; rostral length 19·7; zygomatic width ——; least interorbital width 7·5; post orbital width 9·4; width of braincase 16·8; mastoid width 17·2; $c^1 - c^1$ (alveoli) 8·9; $m^1 - m^1$ 13·6; $c - m^1$ 18·2; length of mandible 39·3; $c - m_2$ 19·6.

COLLECTION AND FIELD NOTES. As for *E. anurus*. If the present specimen really is a different species, it is surprising that it formed part of such a closely knit social group with *E. anurus*.

Micropteropus pusillus (Peters, 1868)

Specimens. Two females and a foetus. Sirba, Blue Nile Gorge, 10° 05′ N, 35° 30′ E, alt. 800 m. 30 August 1968.

Taxonomic notes. There appears to have been hitherto no confirmed record of *Micropteropus* from Ethiopia, although *M. pusillus* occurs in the southern Sudan (Kock, 1969 : 24).

Collection and field notes. Found at night between 20.00 hrs and 21.00 hrs flying around under large fig trees at the edge of the Nile. Both specimens caught in small hand-held mist nets. One animal was found to be pregnant with a well formed foetus, suggesting that breeding may coincide with the wet season (just ending at this time) and maximum availability of fruit such as figs.

Additional material. Apart from the specimens obtained by the Great Abbai Expedition, the collections of the British Museum (Natural History) include three further Ethiopian specimens (B.M. 28.1.11.5–7) obtained at the Donkam River, Great Abbai, 100 miles southwest of Lake Tana, at 5,000 feet, by R. E. Cheesman, which presumably led Ellerman, Morrison-Scott and Hayman (1953 : 49) to include Ethiopia in the distribution of the species.

Rhinopoma hardwickei sennaarinese Fitzinger, 1866

(Plate 3 (a))

Specimens. (1) Three males, three females. North eastern slope of Mount Fantalle, Shoa. 08° 58′ N, 39° 54′ E, alt. 1,000 m. 28 September 1968.

(2) Two males, nine females. North bank of Awash River, Awash National Park, Shoa. 08° 30′ N, 40° 01′ E, alt. 1,000 m. 25–28 September 1968.

(3) Skulls from cave deposit. Near Metahara, Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. 1,000 m. 28 September 1968.

Taxonomic notes. Kock (1969 : 35) has reviewed *R. hardwickei* with particular reference to forms inhabiting northeastern Africa and has concluded that larger specimens from the Sudan, Mauretania, northwest Africa, Lower Egypt, Israel, Jordan, Aden and Sokotra should be referred to *R. h. sennaariense* Fitzinger, 1866, a name thought for many years referable to *R. microphyllum*. *Rhinopoma hardwickei cystops* Thomas, 1903, to which all specimens from Egypt, the Sudan and Ethiopia were formerly referred is considered by Kock to be a smaller subspecies inhabiting Middle Egypt and extending westwards to Hoggar and Air in the Sahara: the small *R. h. macinnesi* Hayman, 1937 is thought by Kock to extend from northern Kenya and the southern Sudan to Somalia and to Eritrea in Ethiopia. These specimens from eastern Ethiopia are similar in size (length of forearm in thirteen examples 52·9–56·6 (55·0)) to those which this author refers to *sennaariense* from Khartoum and are considerably larger than *macinnesi* (length of forearm 46·6–48·4, according to Kock (pp. 45, 50)).

Collection and field notes. The living bats were all shot or netted inside some small lava blister caves in the middle of the day. These provided the only shade and cool shelter in an otherwise hot, dry and very open terrain, covered with sparse thorn scrub, boulders and dry grass. Large numbers of *Rhinopoma* were found in these caves, often hanging from the roof in small solid masses of a dozen or more individuals. A sample of the bats was collected at random: the colonies contained both sexes, but no signs of any young were seen. *Rhinopoma* was also well represented among skeletal material removed from the floors of two of the lava caves.

Taphozous perforatus haedinus Thomas 1915

Specimens. (1) Thirteen males, eight females. "Forward Base Two", 10 km west of Mabil, Blue Nile Gorge. 10° 19′ N, 36° 45′ E, alt. c. 1,300 m. 19 August 1968.

(2) One male, three females. North Bank of Awash River, Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. 1,000 m. 25–27 September 1968.

Taxonomic notes. These specimens do not support the view (Harrison, 1961 : 150; 1962 : 763) that two closely related species of the *Taphozous perforatus* group exist in Africa, one, *perforatus*, with dark wings, the other, *sudani*, with pale or whitish wings, the two being separated also by a small difference in the size of the braincase, that of *sudani* being on the whole very slightly larger than that of *perforatus*. As noted by Kock (1969 : 74), who also rejects this view, the pigmentation of the wing membrane is variable. A number of the Ethiopian specimens have dusky wing membranes but in others the wing membranes are translucent, especially distally, and in this respect are closely similar to *sudani*. Similarly, the dimensions of the braincase in the Ethiopian specimens bridge the narrow interval separating *perforatus* from *sudani*. It is evident, therefore, that but a single species must be recognized, a course adopted by Rosevear (1965 : 151) and by Kock (1969 : 74) but counter to the opinion of Harrison (1961 : 150, 1962 : 763), who divided the group into two species, *perforatus* having a northern and eastern distribution in Africa, with *sudani* distributed from the Sudan to southern Africa.

Subspecific classification in *T. perforatus* is less clear, and final clarification must, it seems, await the advent of more material. The collections now available in the British Museum (Natural History) suggest that a pale subspecies (*T. p. perforatus* E. Geoffroy, 1818) occurring in northeastern Pakistan and in Egypt is replaced in the Sudan and Congo by a darker, slightly larger subspecies (*T. p. sudani* Thomas, 1915) which in turn in Ethiopia and Kenya gives way to an equally dark but slightly smaller subspecies (*T. p. haedinus* Thomas, 1915: according to Kock (1969 : 80) *Taphozous maritimus* Heuglin, 1877 may be a prior name) extending to Somalia, Eritrea and southwestern Arabia. Specimens from southwestern Arabia are generally referred to *T. p. haedinus* but on the whole are a little paler than are those from Ethiopia and Kenya and thus tend towards *T. p. perforatus*: a small number of specimens reported as *T. perforatus* by Harrison (1968 : 323) from Oman

TABLE I

Measurements of *Taphozous perforatus*

	Number of specimens	Length of forearm	Number of specimens	Condylocanine length	Number of specimens	Width of braincase	Number of specimens	c–m³
T. p. perforatus India	18	58·5–63·2 (61·0)	16	18·3–19·3 (18·9)	16	9·2–9·5 (9·3)	17	8·0–8·6 (8·3)
T. perforatus Oman*	9	58·9–62·0 (60·7)	—	—	8	8·9–9·3 (9·1)	9	8·2–8·6 (8·4)
T. p. perforatus Egypt, Sudan	9	59·8–62·9 (61·4)	11	18·8–19·5 (19·0)	10	9·2–9·5 (9·4)	13	7·9–8·6 (8·3)
T. p. haedinus S. W. Arabia	13	60·6–65·4 (62·0)	11	18·6–19·5 (19·1)	11	9·0–9·6 (9·4)	12	8·2–8·8 (8·5)
T. p. haedinus Ethiopia	24	60·5–64·8 (62·7)	14	18·9–19·7 (19·4)	14	9·2–9·8 (9·5)	14	8·3–8·7 (8·6)
T. p. haedinus Kenya	8	60·5–64·2 (62·6)	7	18·9–19·6 (19·3)	6	9·3–9·8 (9·6)	8	8·4–8·9 (8·6)
T. p. sudani Sudan	7	62·0–65·7 (64·1)	6	19·3–20·0 (19·7)	7	9·7–10·1 (9·9)	7	8·5–9·0 (8·7)
T. p. swirae N. Nigeria**	11	60·2–63·2	11	18·3–19·1	11	9·0–9·3	11	7·8–8·2
T. p. swirae W. Africa	3	58·7–59·8 (59·3)	2	19·2	2	9·3–9·6	3	8·3–8·4 (8·4)
*T. p. rhodesiae**** Rhodesia	4	61·2–62·8 (61·9)	—	—	6	9·3–9·8 (9·6)	8	8·7–8·8 (8·8)

* From Harrison (1968 : 324). ** From Harrison (1958 : 145). *** From Harrison (1962 : 765).

are said by that author to be distinctly paler than *T. p. haedinus* and hardly distinguishable in colour from material from Sudan and Cutch. Specimens from Northern Nigeria have been separated as a distinct subspecies, *T. p. swirae* Harrison, 1962, on account of their greyish coloration: Kock (1969 : 80) lists this as a synonym of *T. p. perforatus* but thinks that there is a possibility that there may exist a distinct western subspecies, for which *Taphozous senegalensis* Desmarest, 1820 would be the earliest name, with *swirae* in synonymy. Extending in West Africa to Senegal, Ghana, Mali and the Cameroon, *T. perforatus* is known also from Tanzania, Botswana and Rhodesia, whence Harrison (1962 : 763) has described a small form, *T. p. australis* (preoccupied: as a subspecies of *sudani*) subsequently renamed *T. p. rhodesiae* (Harrison, 1964a : 2) and considered a synonym of *T. p. sudani* by Kock (1969 : 81). Measurements of *T. perforatus* appear in Table 1.

COLLECTION AND FIELD NOTES. The specimens obtained near Forward Base Two all came from some small caves which lay at the head of a stream gulley, high up the side of the Nile Gorge. The gulley was steep, vertical in places, thickly over-grown and passed through dense thorn scrub covering the hillsides. The caves themselves were shallow and although dim light penetrated almost to their furthest extremities, they provided cool shelter from the sun.

Large numbers of *Taphozous* were found together with single specimens of *Nycteris thebaica* and *Hipposideros ruber*. The cave floor was thickly carpeted with guano, and in one area, littered with the wings of large insects. These are presumed to represent the remains of insect prey caught in flight by the bats and taken back to the roost where the thick bodies were eaten and the wings discarded. From their size and abundance it is assumed that these insects were the prey of *Taphozous*, rather than of the two smaller and less numerous bats. An endeavour was made to collect all wings in reasonable condition from the pile and these have been identified for the most part by Mr. Alan Brindle of the Manchester Museum, the remainder having been examined at the British Museum (Natural History): the species encountered are listed in Table 2, with their relative abundance.

An attempt was made to catch all the bats in the colony and in all, 40 *Taphozous* were obtained, leaving behind a few individuals that had retreated to inaccessible parts of the cave. All the bats were sexed and weighed in the field, then 21 of the *Taphozous* sample were released. The sex ratio in the full sample was 19 males: 21 females. Weights ranged from 17 gms to 23 gms, with only two animals exceeding 22 gms. The average weight was 19·5 gms with no significant sex difference. From the narrow size range, and the presence of both sexes in equal numbers and similar body weights it is evident that this was not a nursing colony and that breeding must occur at some other time of year, perhaps in a different place.

The *Taphozous* collected in the Awash National Park were just a small sample taken to record their presence in the lava bubble caves. Here again the cavities were light throughout, but provided shelter and shade in an otherwise very open habitat.

TABLE 2

Identities and abundance of insect wings from a roost of *Taphozous perforatus*

Species identified	Number obtained
Orthoptera	
Tettigoniidae	
Diogena fausta (Burmeister)	1
Mantodea	
Tarachodes sp.	1
Polispilota aeruginosa (Goeze)	1
Lepidoptera	
Saturnidae	
Nudaurelea macrophthalma Ky	2
Gyanisa maja Klug	1
Sphingidae	
Agrius convolvuli (Linnaeus)	35
Hippotion eson (Cramer)	7
Hippotion osiris (Dalman)	1
Hippotion celerio (Linnaeus)	1
Nephele peneus (Cramer)	1
Platysphinx stigmatica (Mabille)	2
Euchloron megaera (Linnaeus)	1

Nycteris thebaica labiata (Heuglin, 1861)

SPECIMENS. (1) One male, three females. Mabil, Blue Nile Gorge. 10° 20′ N, 36° 45′ E, alt. c. 1,200 m. 18 August 1968.

(2) Two females, one male. "Forward Base Two", 10 km west of Mabil, Blue Nile Gorge. 10° 19′ N, 36° 45′ E, alt. c. 1,000 m. 18–19 August 1968.

TAXONOMIC NOTES. These specimens are similar in size (length of forearm 41–45) to examples of *N. t. thebaica* from Egypt and from other localities (Gondar; Gallabat; Ghibbey Valley, 08° 15′ N., 37° 55′ E.) in western Ethiopia but are slightly greyer ventrally. For this reason they are referred provisionally to *N. t. labiata* from Keren. The subspecies of *N. thebiaca* are discussed by Kock (1969 : 98).

COLLECTION AND FIELD NOTES. The Mabil specimens were shot in the roof of a disused hut standing on a hilltop in open cultivated ground. One of the Forward Base Two specimens was taken from the same small caves as the large sample of *Taphozous* (above), the others from a similar little rock shelter lower down the same river gulley.

ADDITIONAL SPECIMENS. The Sandhurst Ethiopian Expedition, 1966 also obtained *N. thebaica* at a locality northeast of Lake Chamo, southern Ethiopia, where specimens were found sleeping separately in deep, shady pits in the ground. Skulls of *Nycteris* sp. were also present among the cave floor bone debris collected from certain lava blister caves in the Awash National Park in September 1968.

Cardioderma cor (Peters, 1872)

SPECIMENS. Skeletal material. Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 28 September 1968.

COLLECTION AND FIELD NOTES. Collected among large numbers of mammal bones found on the floor of the lava blister caves.

ADDITIONAL SPECIMEN. A skin, thought to be *Cardioderma*, formed part of a small collection of local mammals held at the HQ of the Awash National Park.

Rhinolophus clivosus acrotis Heuglin, 1861

SPECIMENS. Skeletal material. Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 28 September 1968.

COLLECTION AND FIELD NOTES. Subfossil cave remains, as for previous species.

Rhinolophus landeri dobsoni Thomas, 1904

SPECIMEN. One male. Temporary Base, mouth of Azir River, Blue Nile Gorge. 10° 29′ N, 36° 25′ E. alt. 1,000 m. 20 August 1968.

TAXONOMIC NOTES. This specimen agrees in size with the type specimen of *dobsoni* from Kordofan and with a small series from the Sudan and western Ethiopia in the collections of the British Museum (Natural History). The series as a whole confirms the measurements of Kock (1969 : 175) and shows that specimens from the Sudan and from Ethiopia are generally smaller (length of forearm in 12 examples 41·5–44·6 (42·8) than those from Malawi (*R. l. lobatus*: length of forearm in 16 examples 42·4–46·6 (44·8)), or from Tanzania (length of forearm in 5 examples 44·4–46·0 (45·1)). Specimens from Zambia are slightly larger than those from Malawi (length of forearm in 11 examples 42·5–47·8 (45·5)) but from Kenya are smaller (length of forearm in 10 examples 41·1–45·8 (43·9)), approaching the northern subspecies in size.

COLLECTION AND FIELD NOTES. Caught in hand-held mist net, 20.05 hrs on open river bank beside tall trees.

Rhinolophus hipposideros minimus Heuglin, 1861

SPECIMEN. One female. Lake Baa-sa-ka, Awash, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 26 September 1968.

TAXONOMIC NOTES. This specimen appears to be the second of *R. h. minimus* to be recorded from Ethiopia, the subspecies being known in northeastern Africa from Keren (the type locality) and from Sennaar, Sudan (Andersen, 1904 : 455). The specimen from Shoa agrees with the Sennaar example excepting only that it has narrower zygomata and has the anterior upper premolar (pm^2) smaller, more rounded and less angular in cross-section. Measurements (the Sennaar example in parentheses): length of forearm 36·7 (35·7); total length of skull to canine 14·4 (14·5); condylocanine length 12·6 (12·7); rostral width 3·4 (3·3); zygomatic width 6·7 (7·5); least interorbital width 1·4 (1·5); width of braincase 6·2 (6·3); mastoid width 6·9 (7·1); c – m^3 5·0 (5·0); c – m$_3$ 5·3 (5·3).

COLLECTION AND FIELD NOTES. Caught after dark (20.00 hrs) in a hand-held mist net as it flew low over the open, muddy lake shore.

Rhinolophus simulator Anderson, 1904

SPECIMEN. One female; B.M. 64.854. Three miles south of Goba, Bale Province, (presumably about 5° 30′ N, 40° 05′ E—P.M.) c. 3,000 m. 1962.

TAXONOMIC NOTES. This specimen was first identified in 1964 on accession to the collections of the British Museum (Natural History) as an example of *R. hipposideros minimus*, but further examination in the course of reporting the Great Abbai material shows that although in the features of the noseleaf it clearly resembles this taxon, it is much too large, particularly cranially, to represent it. It is referred to the rather larger *R. simulator*, not hitherto reported from any more northerly locality than southern Tanzania, although Dr. K. Koopman (in litt.) of the American Museum of Natural History has identified specimens from western Kenya and the southern Sudan with this species.

The Ethiopian specimen agrees closely with *simulator* in the structure of the sella, which is wide and very slightly constricted at a point a little above its centre and in its low, rounded connecting process which rises slightly above the rounded tip of the sella. The lateral margins of the lancet are slightly concave and the lancet itself is rounded towards the tip to form a broad point. Apart from its generally smaller size, the skull agrees closely with that of *simulator*, with prominent rostral swellings, a shallow rostral sulcus, the anterior upper premolar (pm^2) in the toothrow and with the second lower premolar (pm$_3$) minute and extruded. Like *simulator*, it differs from *R. swinnyi* and *R. denti* (perhaps conspecific) in larger rostral swellings, the presence of a rostral sulcus and in having a longer supraorbital region. *Rhinolophus alticolus* Sanborn, 1936 from the Cameroon is also very like *simulator*, differing chiefly in slightly larger size, rather less acuminate lancet and in having the mesopterygoid fossa a little wider. There can be little doubt that *simulator* and *alticolus* are conspecific: the single specimen from Ethiopia points to the possible existence of a generally smaller montane subspecies in that region, a matter to be resolved by further specimens. The prior name is *simulator* by many years: *alticolus*, first described as a subspecies of *R. alcyone*, has evidently no close affinity with that species. Measurements of *R. simulator* are compared in Table 3.

COLLECTION AND FIELD NOTES. Collected by P. M. Barrer and presented by the Imperial College (University of London) Ethiopian Expedition 1962.

TABLE 3

Measurements of *Rhinolophus simulator*

Registration Number	Sex	Length of forearm	Greatest length of skull to canine	Condylocanine length	Rostral width	Zygomatic width	Least interorbital width	Width of braincase	Mastoid width	$m^3 - m^3$	Length of mandible	c – m3	Locality
R. s. simulator													
95.7.1.4	♂	43·9	—	—	4·3	—	—	—	—	6·4	11·6	6·9	Rhodesia
95.7.1.5	♂	44·2	—	—	4·5	8·7	2·0	—	—	6·7	11·5	7·0	,,
4.12.1.4	♀	43·8	—	—	4·3	8·8	2·2	—	—	6·6	—	7·0	,,
4.12.1.5	♀	42·7	—	—	—	—	—	—	—	—	—	—	,,
5.12.9.89	♀	—	—	—	4·8	9·1	2·2	—	—	6·9	11·8	7·3	Transvaal
59.355	♂	42·5	18·8	16·6	4·5	9·1	2·3	8·9	9·4	6·7	—	7·0	Zambia
66.5445	–	44·5	—	—	4·7	—	2·4	—	—	6·7	—	7·1	,,
68.999	♂	44·2	18·7	16·5	4·8	8·8	2·2	8·7	9·2	6·6	11·8	7·0	,,
68.1000	♀	44·5	18·8	16·4	4·4	9·0	2·2	8·6	9·2	6·5	11·7	6·9	,,
68.1001	♂	42·9	18·3	16·1	4·6	8·9	2·2	8·4	9·1	6·4	11·5	6·7	,,
68.1002	♂	42·9	18·5	16·4	4·5	9·0	2·2	8·3	9·0	6·5	11·3	6·9	,,
14.6.13.2	♂	43·0	—	—	4·3	—	—	—	—	6·6	—	7·0	Malawi
11.4.23.1	–	44·2	18.0	15.9	4.4	—	2·2	8·4	9·0	6·2	—	6·5	Tanzania
R. simulator													
64.854		42·6	17·5	15·4	4·3	8·5	2·0	7·7	8·4	6·0	—	6·4	Ethiopia
R. s. alticolus													
56.187	♂	46·3	18·7	16·7	4·9	—	2·2	—	9·1	6·8	—	7·3	Cameroon
56.188	♀	46·5	18·6	16·3	4·8	8·9	2·3	8·1	9·0	6·6	—	7·0	,,
68.895	♂	45·5	—	—	—	—	—	—	—	—	11·8	7·2	,,
68.896	♂	45·8	19·1	16·9	4·9	9·3	2·2	8·3	9·3	6·9	11·9	7·2	,,
68.897	♂	46·2	18·8	16·7	4·9	9·3	2·3	8·3	9·3	6·7	11·7	7·3	,,
68.898	♂	44·9	18·8	—	4·9	8·9	2·3	—	—	6·8	11·7	7·2	,,

Rhinolophus fumigatus fumigatus Rüppell, 1842

SPECIMENS. (1) One female. Mouth of Fincha River, Blue Nile Gorge, 10° 03′ N, 37° 20′ E, alt. 1,000 m. 12 August 1968.

(2) One male. About 30 km southeast of "Portuguese Bridge", near Mota, Blue Nile Gorge, 11° 20′ N, 38° 10′ E, alt. c. 1,300 m. 22 September 1968.

COLLECTION AND FIELD NOTES. Both specimens shot; the Fincha River one coming from a small rock fissure on a rocky hillside covered with thorn scrub and the other from a cave in a cliff beside the Nile.

Hipposideros caffer caffer (Sundevall, 1846)

SPECIMEN. One male. "Forward Base Two", 10 km west of Mabil, Blue Nile Gorge, 10° 19′ N, 36° 45′ E, alt. c. 1,000 m. 18 August 1968.

TAXONOMIC NOTES. Hitherto, many authors have followed Andersen (1906 : 275) in maintaining *H. caffer* as a polytypic species with a number of subspecies among which wide intergradation occurred. However, Hollister (1918 : 85) considered that two species, readily separable by size, were to be found together in East Africa, and, more recently, Lawrence (1964 : 1) has suggested that the relative sizes of the narial compartments can be used as a specific distinction between these, the putative subspecies *caffer* and *ruber*. This author did not, however, attempt to allocate the various named forms hitherto ascribed to *caffer* beyond suggesting that *centralis* should be associated with *ruber* rather than with *caffer*. Kock (1969 : 130, 133) also discusses the classification of the group and concludes that two species can be recognized. Specimens from the Great Abbai Expedition and others from Ghana examined recently confirm the views of these authors and have prompted a further examination of the entire complex as it is represented in the collections of the British Museum (Natural History). The majority of specimens can be allocated readily to one or other of two groups, as Koopman (1966 : 158) has noted. One (*caffer, angolensis, tephrus, ?nanus*) is composed of smaller (length of forearm usually less than 48), generally more greyish (in the dull phase) forms with small median posterior narial compartments and wide lateral inflations. Those allocated to the second group (*ruber, centralis, guineensis, niapu*) are generally larger (length of forearm usually greater than 48), browner (in the dull phase) and have larger median posterior narial compartments with narrow lateral inflations. There is evidently an ecological preference as is indicated by Verschuren (1957 : 354, 373 for *centralis* and *nanus*), Lawrence (1964 : 4) and Koopman (1966 : 158), the members of the first group occurring in the drier woodland and savannah regions, those of the second group in wetter, densely forested areas, as suggested by Brosset (1968 : 338). There exist, however, wide areas of sympatry on the fringes of the forest areas and this has led to the difficulties encountered when all of the named forms are considered to be subspecies of a single polytypic species (Hill, 1963 : 63). Members of either group may be readily recognized over most of Africa but in northern Angola and the Lower Congo the local representative (*centralis*) of the larger group is reduced in size and distinction from that (*angolensis*) of the smaller group is difficult. This circumstance led Koopman (1966 : 158) to retain the concept of a single polytypic species. Both species occur in two colour phases: in the dull phase *caffer* is greyish and *ruber* brownish, while the bright phase of *caffer* is some shade of orange, of *ruber* more rufous.

Hipposideros caffer is distributed throughout most of Africa excluding the central forested region from Morocco to Senegal, Sierra Leone, Ghana, Senegambia, Nigeria, northeastern Congo, Sudan, Ethiopia, Somalia, Kenya, Tanzania (including Zanzibar), Pemba Island, Zambia, Rhodesia, Malawi, Natal, Transvaal, Cape Province, South West Africa, Angola and Gabon: outside Africa the species extends to the Yemen. The following subspecies may prove valid:

Hipposideros caffer caffer (Sundevall, 1846)

Mainly northeastern, eastern and southern Africa.

Hipposideros caffer angolensis (Seabra, 1898)

South West Africa; Angola; Gabon; Lower Congo.

Hipposideros caffer tephrus Cabrera, 1906

Northern and northwestern Africa; drier regions of West Africa.

Hipposideros caffer nanus J. A. Allen, 1917

Northeastern Congo.

It seems that *aurantiacus* de Beaux, 1924 from Somalia is based on an example of *H. c. caffer* in the red or brighter phase, while apparently *braima* Monard, 1939 from Portuguese Guinea should be synonymized with *H. c. tephrus* (Aellen, 1956 : 26; Rosevear, 1965 : 226). Lawrence (1964 : 3) and Koopman (1965 : 10, 1966 : 158) agree that *nanus* J. A. Allen, 1917 is a subspecies of *H. caffer*.

Specimens from the Sudan are referred to *H. c. tephrus* by Koopman (1965 : 10) and Kock (1969 : 130). The Ethiopian specimen from the Great Abbai collection, however, has a generally slightly larger skull than *tephrus* and consequently is referred to *H. c. caffer*. Measurements; length of forearm 46·9; greatest length of skull to canine 17·2; condylocanine length 14·9; rostral width 4·4; zygomatic width —; least interorbital width 2·8; width of braincase 8·6; mastoid width 9·4; $c^1 - c^1$ 4·0; $m^3 - m^3$ 5·8; $c - m^3$ 5·8; length of mandible 10·1; $c - m_3$ 6·4.

COLLECTION AND FIELD NOTES. The single specimen was caught after dark (20.45 hrs) in a hand-held mist net as it flew low over a flat riverside sandbank in an area of thick bush.

Hipposideros ruber centralis Andersen, 1906

(Plate 3 (b))

SPECIMENS. (1) One female. Mouth of Fincha River, Blue Nile Gorge. 10° 03′ N, 37° 20′ E, alt. 1,000 m. 12 August 1968.

(2) Two males and two females. "Forward Base Two", 10 km west of Mabil, Blue Nile Gorge. 10° 19′ N, 36° 45′ E, alt. 1,000 m. 15–19 August 1968.

(3) One male. "Forward Base Three", mouth of Didessa River, Blue Nile Gorge. 10° 05′ N, 35° 38′ E, alt. c. 1,000 m. 26 August 1968.

TAXONOMIC NOTES. Reasons for regarding *ruber* as a distinct species rather than a subspecies of *caffer* are discussed above. It is of interest to note that specimens (B.M. 67.1135–1140) collected by the Sandhurst Ethiopian Expedition, 1966 at the southwest corner of Lake Abaya are also referable to *H. r. centralis* which clearly extends some distance into Ethiopia.

Hipposideros ruber is distributed through the forests and savannahs of Ethiopia, the Sudan, Uganda, Kenya, Tanzania, Zambia, Angola, Gabon, Congo (Kinshasa), Congo (Brazzaville), Cameroon, Fernando Poo, Nigeria, Ghana, Gambia, Sierra Leone, Liberia, Spanish Guinea, Senegal, São Tomé Island and Principe Island. Possible subspecies are:

Hipposideros ruber ruber (Noack, 1893)

Tanzania, Zambia, Angola (Sanborn, 1950 : 58).

Hipposideros ruber centralis Andersen, 1906

Ethiopia, Sudan, Uganda, Kenya.

Hipposideros ruber guineensis Andersen, 1906

West Africa.

Hipposideros ruber niapu J. A. Allen, 1917

Northeastern Congo.

Specimens reported by Aellen and Brosset (1968 : 447) as *H. caffer* from Congo (Brazzaville) seem likely to represent *ruber* (possibly *H. r. centralis*): others reported from the Cameroon by Aellen (1952 : 72, 73) as *H. c. caffer* and *H. c. angolensis* seem from measurements to be referable to *H. ruber*. Aellen (loc. cit., pp. 74, 75) also records *guineensis* and *ruber* from the Cameroon, as subspecies of *H. caffer*.

COLLECTION AND FIELD NOTES. The Fincha River specimen, and three of those from Forward Base Two were all caught after dark in a hand-held mist net as they flew low over riverside sand banks in thick scrub habitat. The specimen from the Didessa River was in rather less open habitat, flying around among riverside bushes at 21.05 hrs. The remaining *H. ruber* from Forward Base Two was netted in the same small caves as large numbers of *Taphozous perforatus* (q.v.).

Two sharply contrasted colour phases are represented in the collection—grey/brown and bright orange/red, with both forms being encountered at a single locality (Forward Base Two).

Asellia tridens tridens (E. Geoffroy, 1818)

SPECIMEN. Skeletal material. Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 28 September 1968.

COLLECTION AND FIELD NOTES. Part of a collection of mammal bones removed from the floor of a lava blister cave.

Asellia patrizii de Beaux, 1931

Specimen. One male. North bank of Awash River, Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 25 September 1968.

Taxonomic notes. This species has been known hitherto only from Danakil, Ethiopia (the type locality) and from two other locations in Ethiopia, namely Assab, Eritrea and Entebebir Island, near Dahlak Kebir Island, off Massawa, Eritrea, the specimen recorded now from the Awash National Park being in fact the first to be received at the British Museum (Natural History). It demonstrates effectively the much smaller skull of *patrizii* when compared with *tridens* which has been obtained (vide supra) in cave remains from the same area. Harrison (1965 : 4) noted that specimens from Entedebir Island are slightly smaller than those recorded from the mainland and thought therefore that they might prove to be subspecifically separable. However, the specimen from the Awash National Park is very similar in size to those reported by Harrison and does not support this view. Measurements: length of forearm 40·1; greatest length of skull 14·7; condylobasal length 13·1; condylocanine length 12·7; zygomatic width 7·6; least interorbital width 1·9; width of braincase 6·1; mastoid width 7·1; $c^1 - c^1$ 3·9; $m^3 - m^3$ 5·2; $c - m^3$ 5·1; $c - m_3$ 5·7.

Collection and field notes. Shot hanging from the roof of a lava blister cave in very dry open, rocky terrain, 1500 hrs.

Triaenops persicus afer Peters, 1877

(Plate 3 (c))

Specimens. (1) One male and one female. "Forward Base Three", mouth of Didessa River, Blue Nile Gorge. 10° 05 ′N, 35° 38′ E, alt. c. 1,000 m. 28 August 1968.

(2) One female. Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 28 September 1968.

Taxonomic notes. Although recorded from Somalia and Kenya, these specimens appear to be the first of *Triaenops* to be reported from Ethiopia. A rather larger subspecies, *T. p. majusculus*, has been described by Aellen and Brosset (1968 : 450) from the Congo (Brazzaville).

Collection and field notes. Both specimens obtained at Forward Base Three were caught with a hand-held mist net. The male was flying low over a maize plot on the bank of the Nile at 19.50 hrs, the female was flying low over the river itself at 22.00 hrs. The habitat is dense trees and bush with areas of maize cultivation, sharply contrasting with the dry, open Awash locality where the other specimen was shot in one of the lava blister caves in the middle of the day.

Additional specimen. A further specimen (B.M. 69.875) collected by Mr. C. Buer and presented by Dr. M. J. Largen has been examined recently. It was obtained on the main road between Lake Langano and Addis Ababa.

Pipistrellus kuhlii fuscatus Thomas, 1901

Specimen. One female. Ghimbi, Wollega. 09° 10′ N, 35° 50′ E, alt. 2,150 m. 31 September 1968.

Taxonomic notes. Mertens (1925 : 22) pointed out that *africanus* Rüppell, 1842 from Shoa is very similar to *fuscatus* Thomas, 1901 from Kenya, for which it is considered a prior name by Kock (1969 : 168).

Collection and field notes. This specimen was obtained "from a house" (presumably in the town of Ghimbi), no further information is available.

Pipistrellus nanus (Peters, 1852)

Specimens. (1) One male and two females. Sabeta, Shoa. 08° 55′ N, 38° 40′ E, alt. 2,500 m. August 1968.

(2) One male. Ghimbi, Wollega. 09° 10′ N, 35° 50′ E, alt. 2,150 m. 2 September 1968.

Collection and field notes. The Sabeta specimens were collected by local children from the axils of banana leaves. The Ghimbi animal was found by a local boy, but no further details are available.

Eptesicus somalicus somalicus (Thomas, 1901)

Specimens. (1) One male and one female. Mouth of Fincha River, Blue Nile Gorge. 10° 03′ N, 37° 20′ E, alt. c. 1,000 m. 12 August 1968.

(2) One immature female. "Forward Base Two", 10 km west of Mabil, Blue Nile Gorge. 10° 19′ N, 36° 45′ E, alt. c. 1,000 m. 15 August 1968.

Collection and field notes. All specimens caught flying low over riverside sandbanks in thick bush habitat, between 20.00 hrs and 20.30 hrs using hand-held mist nets.

Additional specimen. A further specimen (B.M. 67.2164) collected northeast of Lake Abaya by the Sandhurst Ethiopian Expedition 1964 is referable to the rather larger species *E. capensis*.

Glauconycteris variegata variegata (Tomes, 1861)

Specimen. One female, "Forward Base Two", 10 km west of Mabil, Blue Nile Gorge. 10° 19′ N, 36° 45′ E, alt. c. 1,000 m. 18 August 1968.

Taxonomic notes. This specimen is the first of *Glauconycteris* to be recorded from Ethiopia. It has large, massive canines and cheek teeth which agree closely with *G. v. variegata* rather than with the Sudanese *G. v. phalaena* in which the dentition is less massive.

COLLECTION AND FIELD NOTES. By chance this specimen was found dead before being eaten by scavengers. It was lying at the river's edge among boulders which are subject to frequent inundation. The surrounding habitat consists of tall trees and dense scrub.

The following new species is described below by the senior author:

Myotis morrisi Hill, **sp. nov.**

(Plates 1, 2 (a, b))

SPECIMEN. HOLOTYPE. B.M. 70.488. Adult female. A flat, card-mounted skin with skull; collector's number A107. "Forward Base Three", mouth of Didessa River, Blue Nile Gorge. 10° 05′ N, 35° 38′ E, alt. c. 1,000 m. 28 August 1968.

OTHER MATERIAL: none.

TAXONOMIC NOTES. DIAGNOSIS. Similar to *Myotis tricolor* (Temminck, 1832) of eastern Africa but differing from this species in its generally more orange dorsal coloration; unicolored and not bicolored ventral pelage; elongate, narrower skull with uninflated braincase and supraorbital region, the braincase shorter, more globular and markedly narrower than in *M. tricolor*, the rostrum proportionately longer and less broadened than in that species. Dentition less massive than in *M. tricolor*; second upper premolar (pm^3) relatively larger and incompletely intruded from the toothrow; second lower premolar (pm_3) relatively larger, not compressed between pm_2 and pm_4; posterior upper premolar (pm^4) with narrower lingual shelf, separated from the lingual shelf of m^1 by a wider interspace.

DESCRIPTION. Of moderate size (length of forearm 45·4) for the genus; anterior margin of ear smoothly convex, posterior margin concavely emarginated in its distal half, the proximal half convex. Tragus long, its length equal to one half of the length of the ear, tapered, with slender, rounded tip directed slightly posteriorly; anterior margin faintly convex, especially distally, posterior margin concave distally, convex proximally, slightly serrated, a small rounded lobe at base beneath an acute, angular emargination just below widest point of tragus. Wing inserted at base of first toe; calcar strongly developed, extending along almost one half of the posterior margin of the tail membrane; no obvious post-calcareal lobe.

Pelage woolly, dorsally overall orange brown, individual hairs tricolored, the basal quarter blackish brown, most of remainder creamy white, hairs tipped terminally with bright orange brown. Dorsal pelage extending narrowly on to the wing membrane and on to the tail membrane for nearly one half of its width. Ventral pelage unicolorous dull creamy white, tinged faintly with brown on chin and flanks. Wing membrane generally black but antebrachium and endopatagium pale orange yellow, a narrow band of the same colour extending across the membrane immediately behind the forearm; anterior edge of membrane and area between first and second metacarpals and tail membrane similarly coloured. Tibia flanked by a narrow band of orange hairs on wing membrane and a wider band of similar hairs on tail membrane. Toes with a sparse covering of long orange hairs.

Skull (Plates 1, 2(a)) elongate, the braincase not especially inflated; rostrum narrow, the supraorbital region not expanded, the supraorbital ridge forming an uninterrupted curve; a shallow, narrow median rostral depression. Narial emargination narrow, V-shaped posteriorly, its apex rounded. Palate long, narrow, anterior palatal emargination rounded posteriorly, extending almost to a line joining the centres of the canines; narrow post-palatal extension; shallow basi-occipital pits. Inner upper incisor (i^2) longer than wide, bicuspid, with strong angular anterior cusp; smaller posterior cusp extending for two thirds of the height of the anterior cusp. Outer upper incisor (i^3) wider than long, bicuspid, closely appressed to inner tooth, cusps lying transversely to line of toothrow. Outer cusp the larger, rising from a narrow cingulum shelf to a height equal to that of the posterior cusp of inner tooth; supported internally by a smaller secondary cusp for two thirds of its height, the tooth somewhat hollowed internally, separated from the canine by a short diastema. Anterior upper premolar (pm^2) about as high as i^3, a little larger at base, in contact with canine, a slender pointed cusp with wide, strong cingulum. Second upper premolar (pm^3) rising slightly above cingulum of pm^2, slightly less than one half its basal area, visible externally, a simple cusp rising from a narrow cingulum, slightly intruded from row but separating pm^2 and the posterior upper premolar (pm^4), in contact with these teeth. Posterior upper premolar (pm^4) with strong cusp and short, narrow lingual shelf with a wide interspace, separating it from the lingual shelf of the first upper molar (m^1). Lower incisors imbricated, first (i_1) and second (i_2) with four cusps, outer cusp of i_1 incipient, of i_2 well developed but lower than inner cusps. Lower premolars not especially compressed: second (pm_3) rather more than one half the height of anterior tooth (pm_2) and approximately one half its basal area, in contact with pm_2 and posterior lower premolar (pm_4), but not compressed or displaced, its length and width equal. The measurements of the new species are compared with those of *M. tricolor* in Table 4.

REMARKS. In some respects *M. morrisi* resembles *M. bocagei* but is larger, has unicolored and not bicolored ventral pelage, a relatively longer rostrum lacking supraorbital inflation, narrower narial and anterior palatal emarginations and relatively narrower palate. Dentally the two species are closely similar but the teeth of *M. morrisi* are more generally massive than are those of *M. bocagei* and *M. morrisi* lacks a protoconule on the anterior ridge of the first and the second upper molars (described in *M. bocagei* by Harrison (1964b : 135).)

Tate (1941 : 539) reviewed the subgenera of *Myotis* and (p. 552) referred *tricolor* to the subgenus *Selysius*. However, both *tricolor* and *morrisi* approach the subgenus *Chrysopteron* in dichromatic wing pattern, although this is less evident in *tricolor*, and in the presence of four lobes on the inner (i_1) and second (i_2) lower incisors, but retain a relatively high braincase and concave frontal profile. I have much pleasure in associating with this new species the name of my co-author, Dr. Pat Morris, of Royal Holloway College, University of London, in recognition of his many services to the study of the Ethiopian fauna while with the Great Abbai Expedition.

TABLE 4

Measurements of *Myotis morrisi* and *M. tricolor*

Registration Number	Sex	Length of forearm	Greatest length of skull	Condylobasal length	Condylocanine length	Width across ante-orbital foramina	Lachrymal width	Zygomatic width	Least interorbital width	Width of braincase	Mastoid width	$c^1 - c^1$	$m^3 - m^3$	$c - m^3$	Length of mandible	$c - m^3$	Locality
M. morrisi																	
70.488 Holotype	♀	45·7	17·5	16·2	15·3	4·3	5·4	—	3·8	7·9	8·6	4·2	6·4	6·8	12·3	7·2	Ethiopia
M. tricolor																	
1937.2.24.13	–	49·5	18·1	16·7	15·6	4·7	5·9	—	4·2	8·6	9·0	4·7	7·4	6·6	12·5	7·2	Ethiopia
40.738	♂	49·1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Uganda
40.739	♀	46·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	,,
40.740	♀	49·8	17·7	16·4	15·8	4·6	5·7	11·1	3·9	8·4	8·9	4·6	7·4	6·8	12·3	7·2	,,
40.741	♀	49·1	18·0	16·3	15·5	4·8	6·0	11·6	4·3	8·7	9·2	4·5	7·6	6·7	12·3	7·1	,,
64.172	♂	49·8	17·7	16·3	15·4	4·6	5·6	—	4·1	8·7	9·0	4·5	7·2	6·6	12·5	7·2	,,
14.5.4.2.	♂	47·6	18·0	17·1	16·1	4·8	6·0	11·4	4·2	8·6	9·0	4·8	7·5	7·0	12·7	7·5	Natal
51.17	♀	50·3	19·1	18·0	17·0	4·7	6·1	12·2	4·0	8·8	9·8	4·9	7·9	7·2	13·7	8·0	,,
51.18	♀	48·5	19·1	17·9	17·3	5·0	6·0	12·2	4·3	8·8	9·5	4·8	8·3	7·5	13·7	8·2	,,
51.19	♀	50·8	18·9	17·6	16·8	5·0	6·3	12·3	4·3	8·8	9·5	4·9	8·0	7·2	—	7·8	,,
51.20	♀	49·7	18·7	17·3	16·5	4·9	6·2	11·6	4·4	8·8	9·1	4·9	7·7	7·3	—	7·8	,,

Collection and field notes. The specimen was caught by Messrs. Yalden, Largen and King of the Great Abbai Expedition, using a hand-held mist net. The bat was flying after dark over the river Nile, near its north bank, at a height of about one metre. The surrounding habitat comprises mainly maize plots and thick bush. The specimen was photographed whilst still alive (Plate 2 (b)).

Scotophilus sp.

Specimens. (1) One subadult male. Mouth of Fincha River, Blue Nile Gorge, 10° 03′ N, 37° 20′ E, alt. 1,000 m. 11 August 1968.

(2) One subadult male. "Forward Base Two", 10 km west of Mabil, Blue Nile Gorge, 10° 19′ N, 36° 45′ E, alt. c. 1,000 m. 15 August 1968.

Taxonomic notes. No attempt has been made to allocate these subadult specimens to any of the named forms of *Scotophilus* in northeastern Africa.

Collection and field notes. Both individuals were found flying over riverside sandbanks at a height of about 2 metres, the surrounding habitat consisting mainly of dense scrub. The Fincha River specimen was shot in flight (with a pistol!) at 19.15 hrs, the other animal was the only bat caught in a fixed, stationary mist net (19.30 hrs) on the whole Expedition, except for bats caught at their roosts.

Miniopterus inflatus africanus Sanborn, 1936

Specimen. One female. North bank of Awash River, Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 23 September 1968.

Collection and field notes. The bat was flying fairly high (6–8 metres) among widely spaced acacia trees in open thorn scrub and grassland. It was shot in flight at 23.00 hrs.

Otomops martiensseni martiensseni (Matschie, 1897)

Specimen. One female, B.M. 69.1256. French Somaliland (Territory Afars and Issas). 11° 46′ N, 42° 39′ E, alt. 1,471 m. 8 August 1967.

Taxonomic notes. This specimen, collected by the Sandhurst French Somaliland Expedition, records *O. martiensseni* for the first time from French Somaliland and represents a wide extension of range from Kenya.

Tadarida pumila (Cretzschmar, 1830)

Specimens. (1) One male and eight females (three of them immature). North bank of Awash river, Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 25–26 September 1968.

(2) Two males and four females. Ghimbi, Wollega. 09° 10′ N, 35° 50′ E, alt. 2,150 m. 1–4 September 1968.

Collection and field notes. The Awash specimens formed part of a roost of bats, living behind the loose bark of a dead tree. A sample of the animals was collected in the late afternoon using a mist net fixed to the tree trunk. Four of the Ghimbi animals (two females and two males) were living in the eaves and under the corrugated iron sheeting of the Mission Church roof, one of the others is recorded as coming from a house and the exact origin of the sixth Ghimbi specimen is not known, though it is likely to have been collected with the rest.

These two localities for *T. pumila* (Awash and Ghimbi) could not be more contrasting and suggest a lack of strict habitat requirements for this bat. The Awash locality was very hot, dry, open bush whereas Ghimbi is 1,200 m higher on the cool, wet, heavily cultivated highland plateau. The only similarities between the two roosts are that the bats were living close together in a narrow, cramped space and both sexes were present in each colony.

Tadarida nigeriae nigeriae (Thomas, 1913)

(Plate 3 (d))

Specimen. One male. North bank of Awash River, Awash National Park, Shoa. 08° 50′ N, 40° 01′ E, alt. c. 1,000 m. 26 September 1968.

Taxonomic notes. There is but one previous record of *T. nigeriae* from Ethiopia (Ingersol, 1968 : 60), from the Gota River in the eastern part of the country. The species has been known hitherto from no locations nearer to Ethiopia than the northeastern Congo and southeastern Tanzania.

Collection and field notes. This single specimen was among a sample taken from the roost of *T. pumila* mentioned above. It seems peculiar that two species should be living behind the same small piece of tree bark in a mixed colony.

Tadarida africana (Dobson, 1876)

Specimen. (1) One male B.M. 28.1.11.40. Fatam river, Great Abbai (=Blue Nile), c. 70 km south of Lake Tana, approx. 10° 25′ N, 37° 00′ E. alt. c. 1,900 m. 17 March 1927.

(2) One specimen B.M. 69.884. ? Vicinity of Addis Ababa.

Taxonomic notes. These specimens are the first of this large molossid to be reported from Ethiopia, reported hitherto from no nearer locality than southwestern Kenya.

Collection and field notes. The Fatam River specimen was collected by Major R. E. Cheesman during one of his survey visits to the Nile Gorge. The other individual was found dead on a telegraph wire by employees of the Imperial Highway Authority and presented by Dr. M. Largen of the Haile Selassie University, Addis Ababa.

Tadarida acetabulosus natalensis (A. Smith, 1847)

Specimen. One female B.M. 6.11.1.9. Given on the specimen label as "between Shoa and Lake Rudolf" Southern Ethiopia.

Taxonomic notes. This single specimen represents a wide extension of range for *T. acetabulosus*, known hitherto from Madagascar, Mauritius, Réunion and Natal, the latter record by A. Smith being hitherto the only evidence of the occurrence of the species on the African mainland. Although Thomas identified the specimen correctly upon its arrival at the British Museum (Natural History) in 1906 the record has remained unpublished and the specimen undisturbed in the collections until it was noted by Mr. R. W. Hayman in 1965.

SUMMARY

The Great Abbai Expedition obtained 115 specimens of bats (including cave remains), chiefly from the Blue Nile Gorge or from the Awash National Park. One specimen from the Blue Nile Gorge proves to represent a new species closely allied to *Myotis tricolor*, for which the name *Myotis morrisi* is proposed. Specimens in the collections of the British Museum (Natural History) and also others collected by the Expedition confirm the presence of *Micropteropus pusillus* in Ethiopia; *Triaenops persicus afer* and *Glauconycteris variegata variegata* were obtained for the first time in Ethiopia by the Great Abbai Expedition, which also obtained further specimens of *Asellia patrizii* and *Talarida nigeriae nigeriae*; a few specimens in the British Museum (Natural History) obtained from other sources and reported in this paper furnish the first Ethiopian records of *Rhinolophus simulator*, *Tadarida africana* and *Tadarida acetabulosus*, and of *Otomops martiensseni* in French Somaliland (Territory Afars and Issas). The classification of *Taphozous perforatus*, *Hipposideros caffer* and *Hipposideros ruber* is reviewed. *Rhinolophus simulator* Andersen, 1904 and *Rhinolophus alticolus* Sanborn, 1936 are considered to be conspecific.

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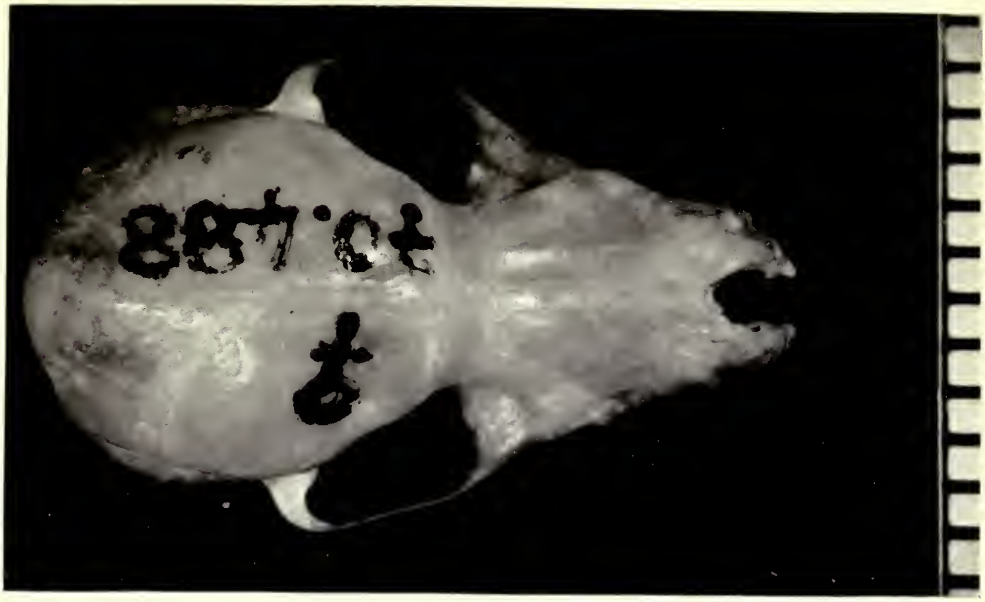
PLATE 1

Myotis morrisi. Skull and mandible ×7·5



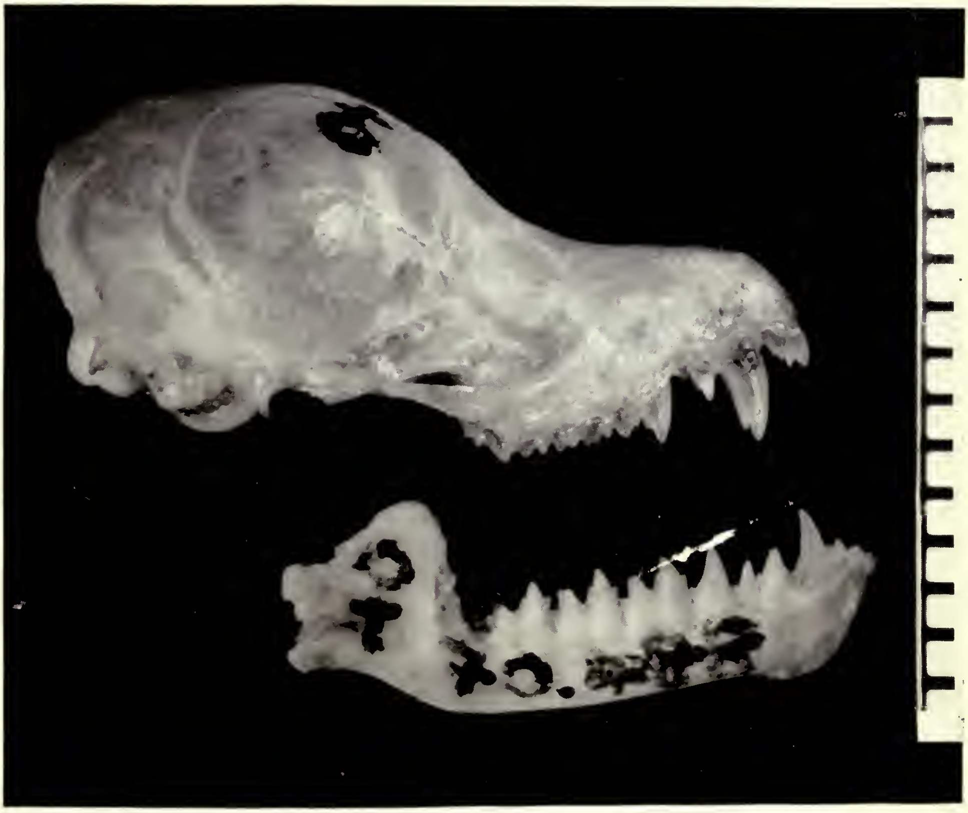
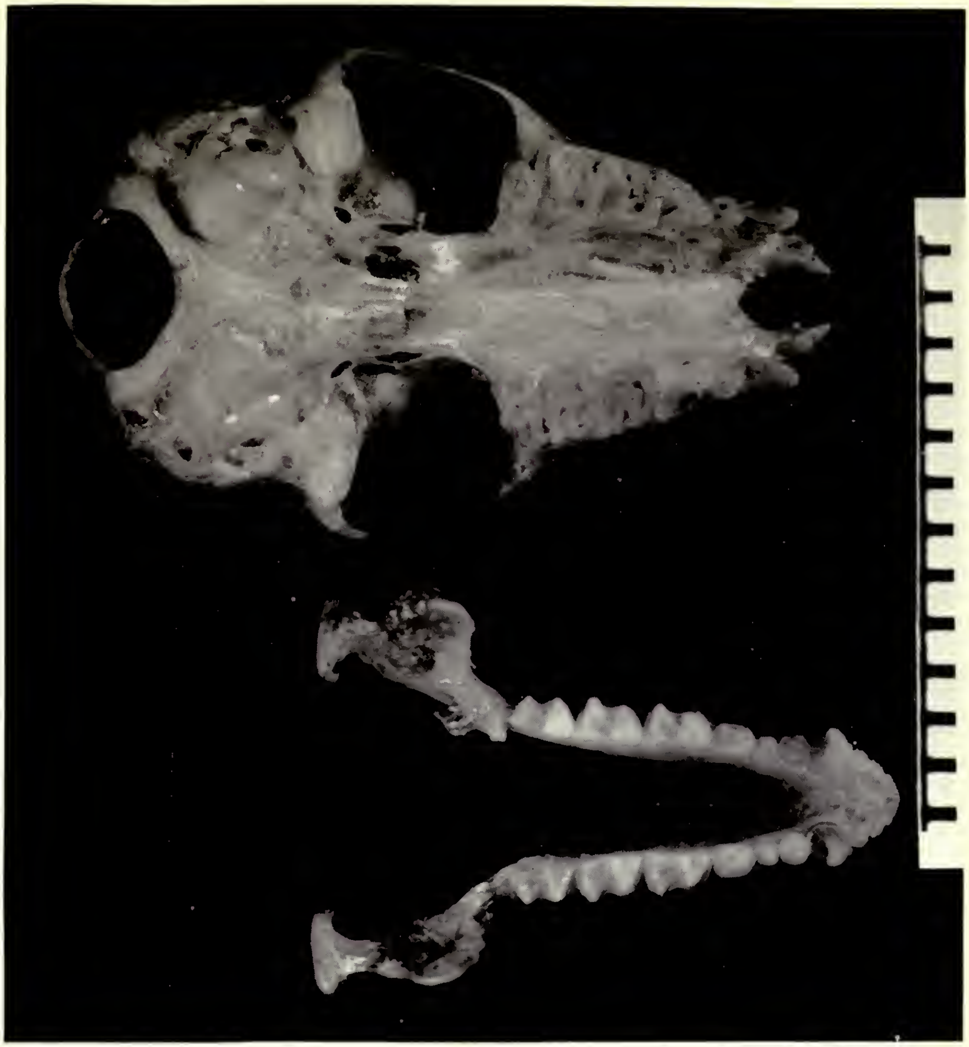


PLATE 2

(a) *Myotis morrisi*. Skull and mandible ×7·5
(b) *Myotis morrisi*.



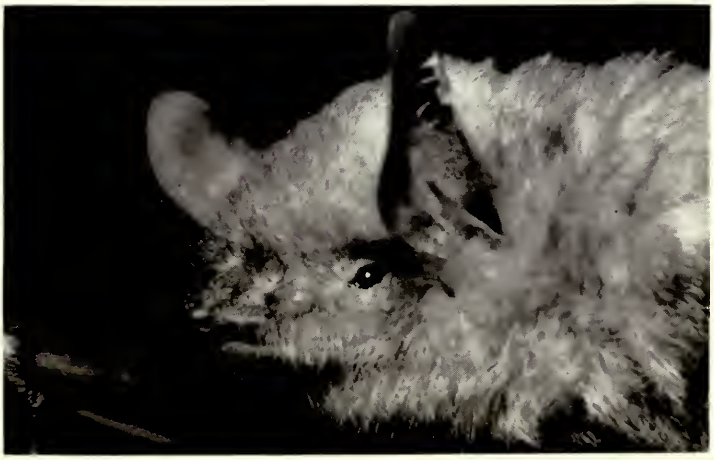
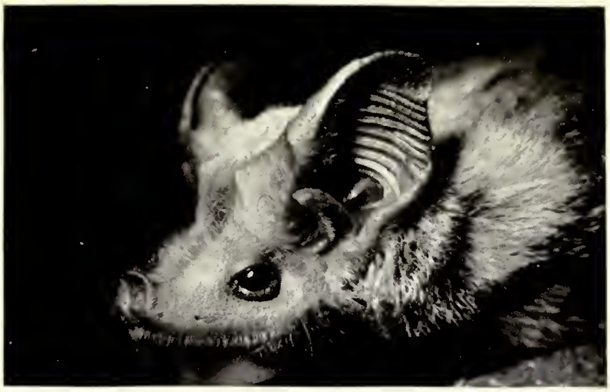


PLATE 3

(a) *Rhinopoma hardwickei sennaariense*
(b) *Hipposideros ruber centralis*
(c) *Triaenops persicus afer*
(d) *Tadarida nigeriae nigeriae*



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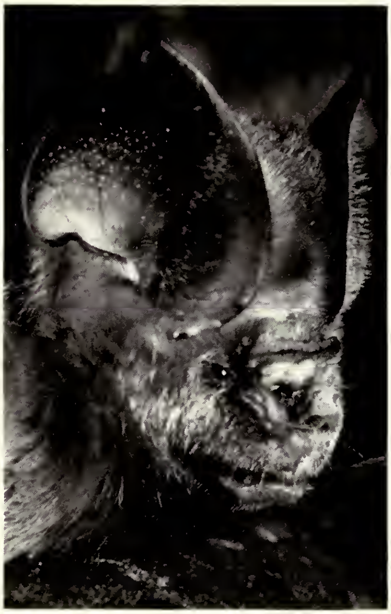

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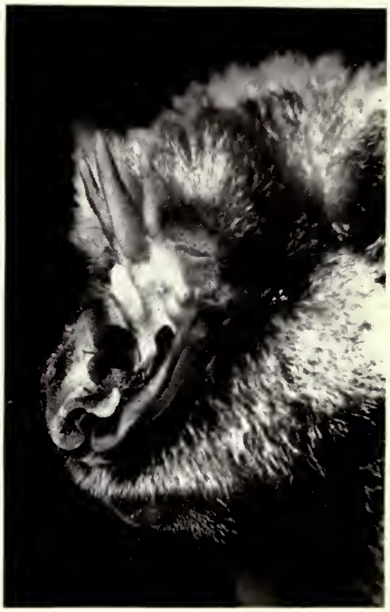

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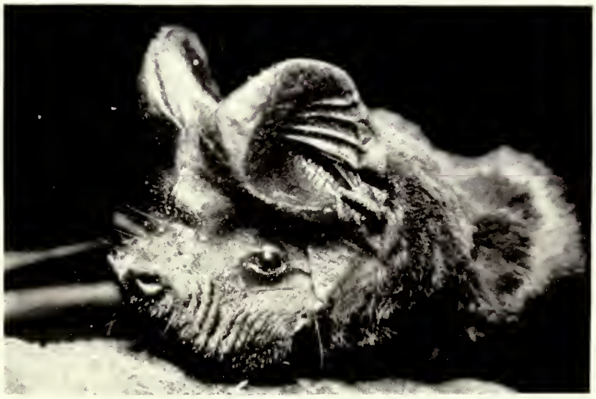

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NATURAL HISTORY

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S. MARKOWSKI

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ZOOLOGY Vol. 21 No. 3
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BY

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Pp. 51–65*; 20 Text-figures*

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TRUSTEES OF
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ON SOME SPECIES OF PARASITIC WORMS IN THE 'DISCOVERY' COLLECTIONS OBTAINED IN THE YEARS 1925–1936

By S. MARKOWSKI†

MATERIAL AND METHODS

THE collection described below was made by 'Discovery' expeditions between the years 1925 and 1936 and consists of twenty-three samples of parasitic worms taken from the muscles and mesenteries, but mostly from the intestinal tract, of four species of fish (*Euthynnus pelamis*, *Coryphaena* sp., *Chaenocephalus aceratus* and *Notothenia rossi*), two species of birds (*Phoebetria fusca* and *Chloephaga picta leucoptera*), two species of seals (*Leptonychotes weddelli*, *Hydrurga leptonyx*) and a blue whale (*Balaenoptera musculus*). The material from seals was collected from six specimens of *Leptonychotes weddelli* and ten of *Hydrurga leptonyx*.

In the material studied, twelve separate species of parasitic worms have been recognized. Of these, two forms of Cestodes seem to represent new species. In three cases, because of the juvenile condition of the specimens, generic determination only was possible.

The bulk of the material was preserved in 4% formalin. Some specimens were prepared as whole mounts, having been stained with Mayer's paracarmine. Serial sections, cut at 8 μm thick, were stained with Ehrlich's haematoxylin and counter stained with erythrosin. The hosts were taken at localities in the Southern Ocean, the precise localities are given with details of each particular species of parasite.

The author takes this opportunity in expressing his thanks to the National Institute of Oceanography for entrusting this material to him and for providing the necessary scientific apparatus.

Thanks are also due to Dr J. P. Harding, Keeper of the Zoology Department of the British Museum (Natural History) for providing the writer with accommodation and the loan of microscopical equipment, and to Mr S. Prudhoe, Mr J. W. Coles and Mr R. A. Bray of the same Museum for their assistance in the course of this investigation, as well as to Professor J. G. Baer, who kindly lent the original material of *Hymenolepis bisaccata* Fuhrmann, 1906 for comparison.

---

†Dr. Markowski died January 5, 1971

TABLE 1

List of hosts and their parasitic worms

Species of hosts	No. of hosts examined	Species of Trematodes	Species of Cestodes	Species of Nematodes	Species of Acanthocephala
Euthynnus pelamis	1		*Tentacularia sp. larvae*		
Coryphaena sp.	1		*Bothriocephalus janickii sp. nov.*		
Chaenocephalus aceratus	1			*Contracaecum sp. larvae*	
Notothenia rossi	1				*Corynosoma hamanni larvae*
Phoebetria fusca	1		*Tetrabothrius heteroclitus*		
Chloephaga picta leucoptera	1		*Hymenolepis prudhoei sp. nov.*		
Balaenoptera musculus	1		*Diplogonoporus balaenopterae*		
Leptonychotes weddelli	6	*Ogmogaster antarctica*	*Diphyllobothrium lashleyi* *Glandicephalus perfoliatus*	*Contracaecum osculatum*	
Hydrurga leptonyx	10		*Diphyllobothrium quadratum*	*Contracaecum osculatum*	

ABBREVIATIONS USED IN THE FIGURES

c	cuticula	t	testis
c.s.	cirrus-sac	u	uterus
ex	excretory vessel	v	vagina
l.m.	longitudinal muscles	v.d.	vas deferens
m.ex.	median excretory vessel	v.g.	vitelline glands
o	ovary	v.s.	vesicula seminalis
s.m.	subcuticular muscles		

SYSTEMATIC NOTES

The material examined contains twelve species of parasitic worms belonging to four different groups and these are enumerated below.

I. TREMATODA

NOTOCOTYLIDAE Lühe, 1909

1. ***Ogmogaster antarctica*** Johnston, 1931

Host: *Leptonychotes weddelli*, intestine. Locality: Falkland Islands 15.7.1928.

Several specimens of this trematode were found in the intestine of two Weddell seals. In one case they were attached to the walls of the intestine close to strobilae of *Glandicephalus perfoliatus*.

Descriptions of this trematode have been given by Johnston (1931 and 1937).

II. CESTODA

TENTACULARIIDAE Poche, 1893

2. ***Tentacularia*** (larvae)

Host: *Euthynnus pelamis*: cysts in the abdominal muscles. Locality: 15°10'N; 18°30'W; 15.10.1925.

Some six specimens are here recorded. Similar larval stages of a tetrarhynch were described from the same host-species by Rennie and Reid (1912).

DIPHYLLOBOTHRIIDAE Lühe, 1910

3. ***Diphyllobothrium lashleyi*** (Leiper and Atkinson, 1914)

Host: *Leptonychotes weddelli* intestine. Localities: Falkland Island, and Grytviken, South Georgia; 15–17.7.1928.

Great numbers of specimens were obtained from each of three seals.

4. *Diphyllobothrium quadratum* (v. Linstow, 1892)

Host: *Hydrurga leptonyx*, small intestine and rectum. Localities: Grytviken, South Sandwich Islands; South Orkney; 15.9, 18–22.1.1928 : 16.2.1931. The material was collected from ten seal-hosts, each showing a very heavy infestation.

5. *Diplogonoporus balaenopterae* Loennberg, 1892

Host: *Balaenoptera musculus*, intestine. Locality: 61°53′S, 87°32′E, 27.1.1936 ('Southern Empress'). Large portions of strobila and few smaller fragments were found in this sample.

6. *Glandicephalus perfoliatus* (Railliet and Henry, 1912)

Host: *Leptonychotes weddelli*, intestine. Localities: Falkland Islands, 15.7.1928; Palmer Archipelago, 8.1.1935.

Parts of the duodenum of two seal-hosts were found infested with this species. Detailed descriptions of the above-mentioned diphyllobothriid cestodes have been given in earlier papers (Markowski, 1952 and 1955).

PTYCHOBOTHRIIDAE Lühe, 1902

7. *Bothriocephalus janickii* sp. nov. Figs 1–5

Host: *Coryphaena* sp.; stomach. Locality 24°05′S, 15°46′N. 27.11.1925.

Some twenty-one fragments and eight complete worms were examined. The strobila is about 8 cm long and very slender, about 1 mm broad. The scolex is very large in relation to the rest of the body, being 5 mm long and 1 mm broad. It is provided with a pair of groove-like bothridia. A neck was not observed (Fig. 1).

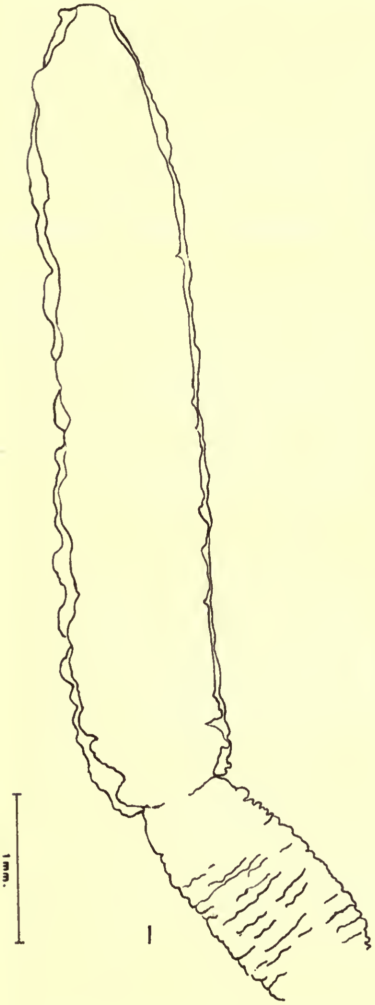
The excretory system consists of two pairs of longitudinal vessels, two individual canals at either side of the body. Of each pair the outward or dorsal vessel is about 5 × 5 μm in diameter and the inward or ventral vessel about 22–27 μm × 14–21 μm. Another single median longitudinal canal of about 11–13 × 5–10 μm is situated at the right side of the cirrus-sac and the uterine opening. Its walls are thick and provided with cells arranged radially, as seen in the Figs 2 and 3.

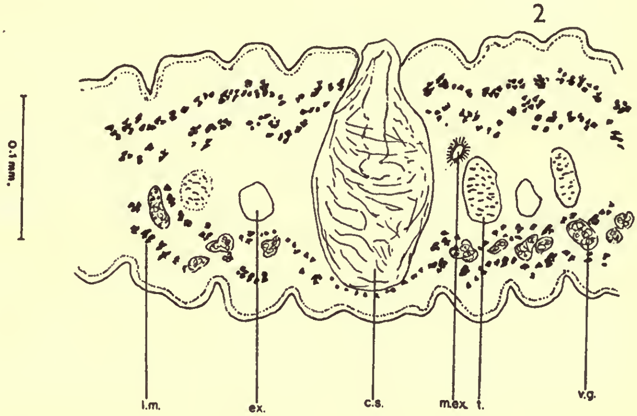
The longitudinal musculature consists of a very thin layer of fibres lying immediately beneath the body-cuticula and two well-developed layers of fibres inserted in the parenchyma (Fig. 4). The cuticula is about 3–5 μm thick.

The sexually-mature segment is from 0·87 mm to 0·9 mm broad, as measured in transverse section. The genital pore, situated dorsally, leads into a shallow genital atrium. The cirrus-sac, measured in the same place, is 160 μm high and 84 μm broad, elongate, pyriform and situated dorsally (Fig. 2). There appear to be about 75 testes, but a more precise number, it has not been possible to determine. They are arranged in a single layer in the central part of the segment and measure about 40–50 × 30–35 μm (Fig. 5).

The ventrally-situated tocostoma or uterine pore leads into an atrium, which as measured in transverse section is 68 μm high and 40 μm wide (Fig. 3).

The vitelline glands are disposed ventrally in a single layer between the longi-





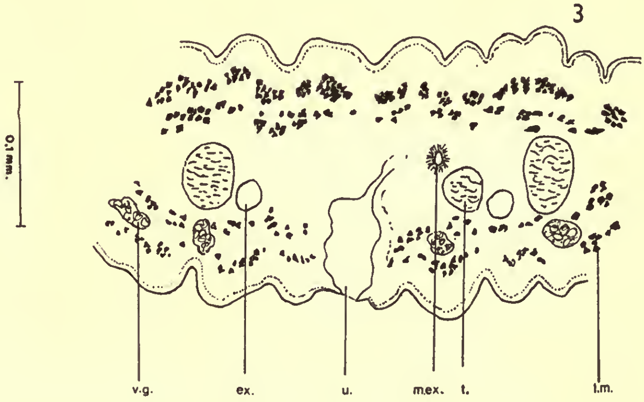


FIG. 1. *Bothriocephalus janickii* sp. nov.: scolex.

FIG. 2. *Bothriocephalus janickii* sp. nov.: cross-section of the segment showing cirrus-sac.

FIG. 3. *Bothriocephalus janickii* sp. nov.: cross-section of the segment showing tocostoma.

tudinal muscles, sometimes slightly overlapping into the lateral fields of the segment. They are about 25–30 × 20 μm (Fig. 4). The ovary is a deeply bilobed structure situated in the middle region of the segment. The eggs are 40–42 × 28–32 μm.

There are five species of *Bothriocephalus* occurring in fish-hosts in the Southern Hemisphere. However, the descriptions of some of them are very inadequate (Prudhoe, 1969).

Bothriocephalus janickii sp. nov. differs from others quoted by Prudhoe (1969) with its unusually large scolex and extremely slender strobila.

The species is named after the well-known Polish zoologist, the late Professor C. Janicki.

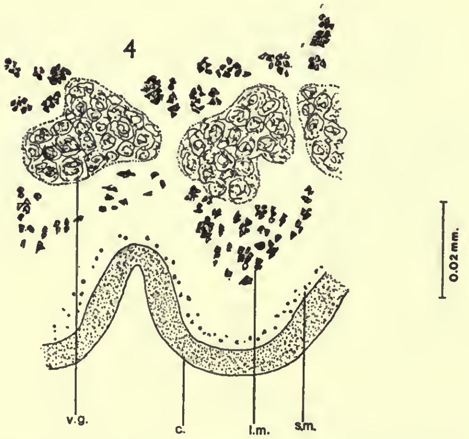
HYMENOLEPIDIDAE Railliet & Henry, 1909

8. ***Hymenolepis prudhoei*** sp. nov. Figs 6–14

Host: *Chloephaga picta leucoptera*, rectum. Locality: Teal Inlet—East Falkland, 5.3.1927.

Some sixty-five adult worms were collected. The length of the strobila in these specimens is about 9 cm and the width 4 mm. The scolex is about 125 μm in length and 137 μm in width (Fig. 6). The rostellar sac is unusually long in comparison with the scolex, being about 187 μm in length and 37·5 μm in width.

The rostellum bears a crown of eight hooks, each measuring 32 μm. They have



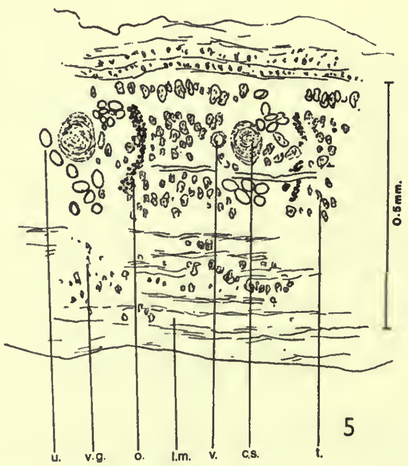


FIG. 4. *Bothriocephalus janickii* sp. nov.: cross-section of the segment showing the arrangement of the longitudinal muscles and vitellaria.

FIG. 5. *Bothriocephalus janickii* sp. nov.: horizontal section of the segment.

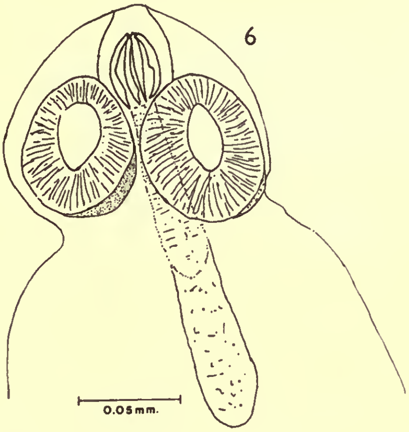
a long well-developed blade, and a very thick, club-shaped handle. The guard is weakly developed (Fig. 7). A neck was not observed. The segments are short, elongate transversely.

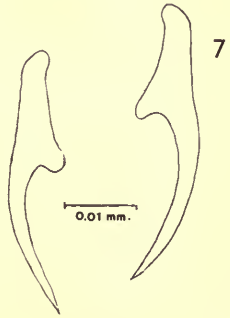
The three testes, 270–212 × 112·5–125 μm are situated posteriorly across the segment in a single row (Figs 8 and 14). The vesicula seminalis is large and situated in the anterior region of the segment (Fig. 9). It opens with a coiled duct into the cirrus-sac, which measures about 130 μm in length and 85 μm in width, and is provided with thick muscular walls (Fig. 10).

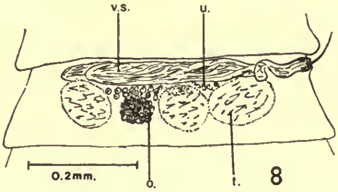
The cirrus is armed with a smooth stylet, which may be observed protruding from the genital opening.

The ovary is more or less rounded and connected with the ramifying uterus, which in the gravid segments occupies the whole proglottis. The embryo is enclosed in two membranes. The size of the outer membrane of the egg is 45 × 40 μm, the inner membrane is 37 × 28 μm and the embryo itself 20 × 28 μm (Fig. 13). Embryonic hooks were not observed.

The longitudinal muscles are well developed and form two layers, of these the outer one is more strongly developed (Fig. 12).







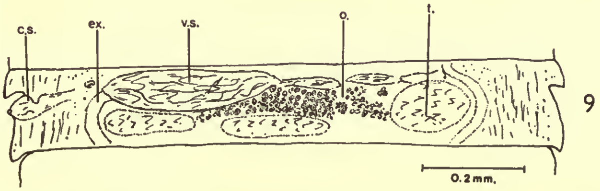
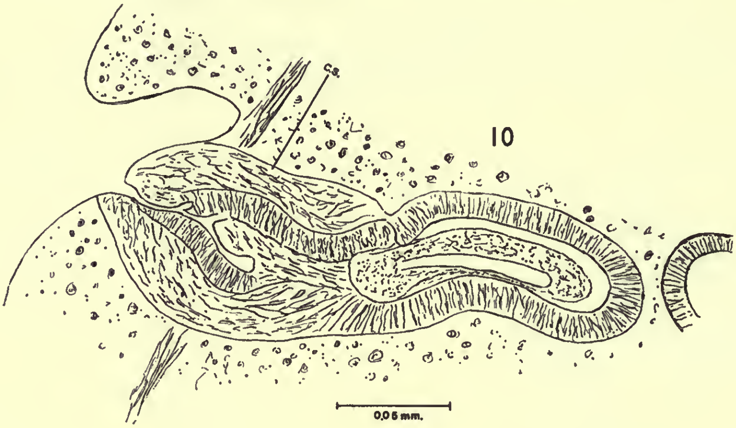


FIG. 6. *Hymenolepis prudhoei* sp. nov.: scolex.
FIG. 7. *Hymenolepis prudhoei* sp. nov.: hooks.
FIG. 8. *Hymenolepis prudhoei* sp. nov.: mature proglottis.
FIG. 9. *Hymenolepis prudhoei* sp. nov.: horizontal section of mature proglottis.

Hymenolepis prudhoei sp. nov. which in some features may be compared with *H. bisaccata* Fuhrmann, 1906, *H. octacantha* (Krabbe, 1869) and *H. philactes* Schiller, 1951, differs in the shape and size of the hooks, which in *H. bissacata* are 37 µm long, and in *H. octacantha* and *H. philactes* 32–40 µm and 31–39 µm respectively. Spasski and Spasskaya (1954) give the size of the hooks in *H. octacantha*: 36–38 µm.

Although there is some similarity between the new form and the other species mentioned, the cirrus-sac is not provided with a *saccus accessorius*, whilst the stylet is smooth and the shape of the testes is also different.

Some Soviet helminthologists, namely Spasski and Spasskaya (1954), Czaplinski (1956), Maksimova (1963), Spasskaya (1966) have erected several new genera by breaking down the genus *Hymenolepis* Weinland (*sensu lato*).



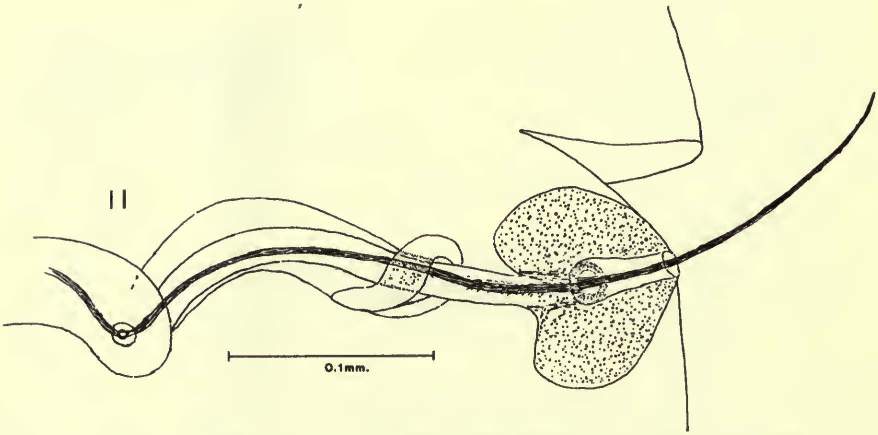


FIG. 10. *Hymenolepis prudhoei* sp. nov.: horizontal section of the cirrus-sac.
FIG. 11. *Hymenolepis prudhoei* sp. nov.: male copulatory apparatus.

As the erection of these new genera does not seem to have produced a clearly understood and concise classification of the species of *Hymenolepis* (*sensu lato*), Weinland's genus in the sense of Fuhrmann's (1932) is here accepted.

From the available literature, it seems, that the cestodes recorded from *Chloephaga picta leucoptera* do not include the form described above. Avery (1966) gives a list of parasitic worms found in this host, but this list is based entirely upon infestation acquired under artificial conditions at Slimbridge, Gloucestershire, where the birds are kept in captivity.

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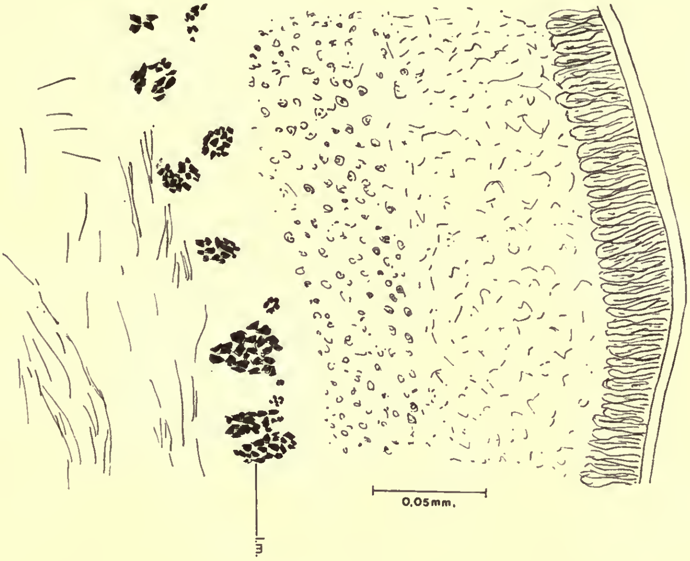

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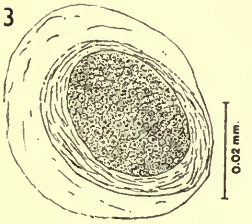

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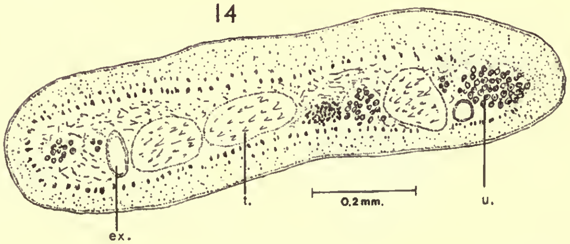


FIG. 12. *Hymenolepis prudhoei* sp. nov.: transverse section of the segment showing the arrangement of longitudinal muscles.

FIG. 13. *Hymenolepis prudhoei* sp. nov.: egg.

FIG. 14. *Hymenolepis prudhoei* sp. nov.: transverse section of a segment.

TETRABOTHRIIDAE Fuhrmann, 1908

9. ***Tetrabothrius heteroclitus*** (Diesing, 1850)

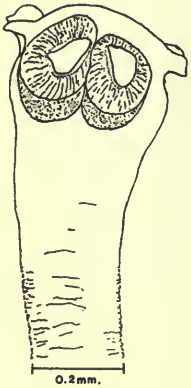
(Figs 15–20)

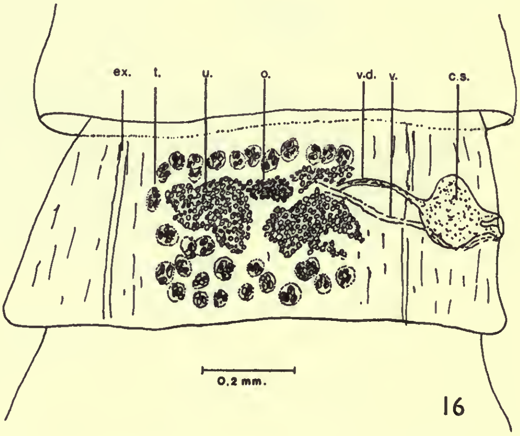
Host: *Phoebetria fusca*: intestine. Locality: Maiviken, West Cumberland Bay, South Georgia 14.12.1926.

Some sixteen complete strobilae and several fragments were collected from the intestine of a sooty albatross.

The length of the strobila is about 18 cm to 20 cm. Its anterior portion is narrow and serrated being about 12 cm in length. The posterior part of the strobila is 2 mm thick, coiled and shows no distinct segmentation. The mature proglottis is 400 μm long and 1 mm broad (Fig. 16). The scolex is 290 μm long and 330 μm wide, and provided with two 'auriculae' (Fig. 15). The width in that part of the scolex is 372 μm. The suckers are 290 μm long and 175 μm across. The longitudinal muscles form two concentric rings. The inner one is more strongly developed (Fig. 19).

15





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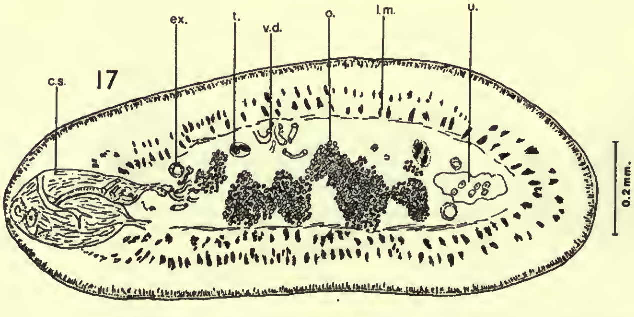
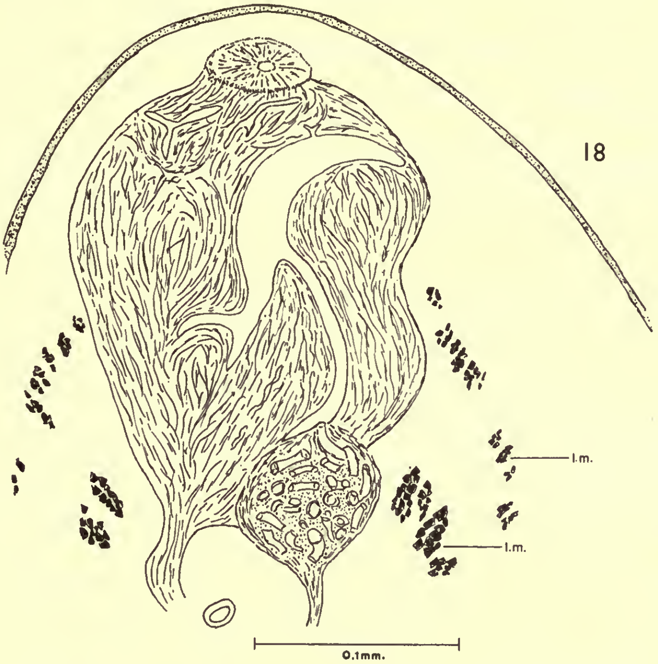
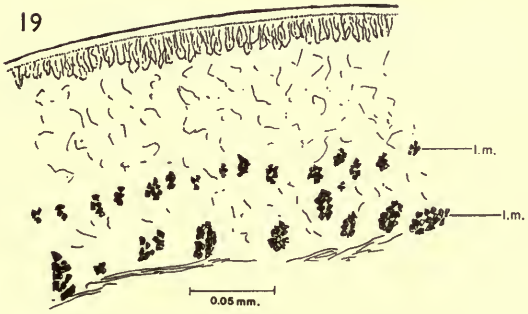


Fig. 15. *Tetrabothrius heteroclitus*: scolex.
Fig. 16. *Tetrabothrius heteroclitus*: mature segment.
Fig. 17. *Tetrabothrius heteroclitus*: transverse section of a mature segment.

The testes, twenty-two to thirty-two, are roundish and situated in the anterior and in the posterior part of the segment, as well as in the aporal region of the proglottis. They are about 40 μm in diameter (Fig. 16). The vas deferens forms numerous coils. The cirrus-sac is 152 × 150 μm in diameter (Figs 17 and 18).

The vagina runs ventrally to the cirrus-sac. The ovary is of an irregular shape. The egg is 45 × 37 μm in total diameter. The diameter of the inner membrane surrounding the embryo is 33 × 22 μm. The embryo is 29 × 20 μm; the embryonic hooks are 12 μm long (Fig. 20). From the available literature, it seems that *Phoebetria fusca* is a new host for *T. heteroclitus*.





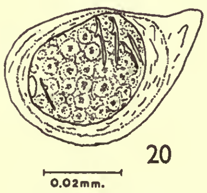


FIG. 18. *Tetrabothrius heteroclitus*: transverse section of a segment showing cirrus-sac.

FIG. 19. *Tetrabothrius heteroclitus*: transverse section of a segment showing the arrangement of the longitudinal muscles.

FIG. 20. *Tetrabothrius heteroclitus*: egg.

III. NEMATODA

HETEROCHEILIDAE (Railliet & Henry, 1915)

10. ***Contracaecum osculatum*** (Rud., 1802)

Host: *Hydrurga leptonyx* and *Leptonychotes weddelli*, intestine. Localities: South Orkneys 16.2.1931; Palmer Archipelago 18.1.1935.

One male and a female specimen were found in the duodenum of *H. leptonyx* and one female in the duodenum of *L. weddelli*.

11. ***Contracaecum*** sp. (larvae)

Host: *Chaenocephalus aceratus*, liver. Locality: Sandford Bay, South Orkney, 24.1.1933.

Mass infestation of the liver of an ice-fish occurred. Because of their larval condition the specific determination of the nematodes has not been possible.

IV. ACANTHOCEPHALA

POLYMORPHIDAE Meyer, 1931

12. ***Corynosoma hamanni*** (v. Linstow, 1892)

Host: *Notothenia rossi*. Locality: South Orkney 17.2.1931.

Numerous larval stages were found in the mesenteries of the host. Baylis (1929) has given a useful description of this species.

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MITES OF THE GENUS *HYPOASPIS* CANESTRINI, 1884 *S.STR.* AND RELATED FORMS (ACARI: MESOSTIGMATA) ASSOCIATED WITH BEETLES

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ZOOLOGY Vol. 21 No. 4
LONDON : 1971

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17 SEP 1971
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BY

MICHAEL COSTA
Kibbutz Mishmar Haemek, Israel

Pp. 67–98; 101 *Text-figures*

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MITES OF THE GENUS *HYPOASPIS* CANESTRINI, 1884 *S.STR.* AND RELATED FORMS (ACARI : MESOSTIGMATA) ASSOCIATED WITH BEETLES

By MICHAEL COSTA

INTRODUCTION

Recently Dr C. Athias-Henriot (Laboratoire de Faune du Sol de l'I.N.R.A., Dijon) forwarded to me mite material collected from the scarabaeid beetles *Oryctes rhinoceros* L. and *Oryctes monoceros* Ol. The beetles and mites were laboratory reared and collected by Dr M. J. Stelzer and Mr B. Zelazny (both from U.N./S.P.C. Rhinoceros Beetle Project, Apia, Western Samoa). Mr Zelazny informed me that the mites feed on the beetles' eggs and may therefore have a possible role in the biological control of *Oryctes rhinoceros*, a main pest of Coco-nut palms. According to Mr Zelazny, the mites originally associated with *O. monoceros*, imported from the Ivory Coast, were even more avid egg feeders on the eggs of *O. rhinoceros* than the locally collected mites. One batch of mites, ex *O. rhinoceros*, was tentatively determined as *Coleolaelaps rhinocerotis* (Ouds.), although I was puzzled by the report on their feeding behaviour. It was generally assumed that mites of the genus *Coleolaelaps* Berlese, 1914 are harmless exudate feeders (Grandi, 1925; Vitzthum, 1940–43). A closer examination of material collected by myself from phytophagous scarabaeids in Israel, material collected by Dr M. Remillet (O.R.S.T.O.M., Centre d'Adiopodoume, Abidjan, Ivory Coast) and material from melolonthine bettles in the U.S.A., showed that '*Coleolaelaps*' served actually as a 'dumping ground' for a number of different genera of mites associated with beetles. The mites of the genus *Coleolaelaps* Berlese, 1914 have been dealt with in a separate study (Costa & Hunter, in press) which has shown that *Coleolaelaps* is not closely related to *Hypoaspis* Can. The present paper will deal with the genus *Hypoaspis* s. str. and some additional forms.

The confusion between *Coleolaelaps* s. str. and *Hypoaspis* s. str. seems to have arisen from the fact that both have long 'wavy' setae on the idiosoma as well as macrosetae on the legs, and both are associated with phytophagous lamellicorn beetles. I should like to point out that the 'wavyness' mentioned by many authors is an artefact of the preparation, the materials used causing apparently a slight contraction of the setal core. In living or alcohol-stored specimens the setae are straight or slightly curved.

Mites of the Hypoaspidinae are generally considered to be the most primitive group in the Laelapidae (Vitzthum, 1940–43; Evans, 1958) but the taxonomic treatment of *Hypoaspis* Can. s. lat. remains controversial. This has been shortly discussed by Hunter & Costa (in press), who retain at full generic status many of the subgenera of *Hypoaspis* which have been recorded, though not used, by Evans & Till (1966). The present study supports this view and proposes to show that mites of the genus *Hypoaspis* s. str. are well defined morphologically as well as ecologically in their host associations. A close examination of the symbiontic mites showed a high degree of host specificity and probably in the past several species have been confused with either *Hypoaspis krameri* Can. (the type species of the genus) or *Hypoaspis integer* Berlese sensu Samšiňák, 1960, both of which have been also confused with each other.

Evans & Till (op. cit.) have recently described and figured both sexes of *Hypoaspis krameri* from specimens associated with *Lucanus* sp. in Great Britain. Their description agrees with the details which can be learned from the descriptions of *H. krameri* by G. & R. Canestrini (1881), G. Canestrini (1885) and Berlese (1892), making the two undoubtedly congeneric. The host association of the British material makes it debatable if this is actually conspecific with the original *H. krameri* which is associated with *Oryctes nasicornis* L. (compare discussion).

In view of the present study a redefining of *Hypoaspis* s. str. seemed to be necessary.

DEPOSITION OF TYPES

The holotypes are deposited in the British Museum (Nat. Hist.). Paratypes will be deposited in The American Museum of Natural History; The Acarina collection, Department of Entomology, University of Georgia and the author's collection.

Hypoaspis Canestrini s. str.

Hypoaspis Canestrini, 1884, *Atti R. Ist. veneto Sci.* (6) 2 : 1569; 1885, *Acarofauna Ital.* part I : 55.

TYPE: *Gamasus krameri* Canestrini, 1881.

FEMALE: Dorsal shield entire, oval, with basically 37 pairs of setae (20 podonotal and 17 opisthonotal, fig. 1). Setae i2, s4–6 considerably longer than remaining setae, setae Z4 extremely long, usually longest idiosomal setae. A tendency exists towards diminishing the number of setae, e.g. in *Hypoaspis integer* Berlese setae z3 are absent in most specimens; in *Hypoaspis phyllognathi* sp. n. seta s3 may be absent on one or both sides and *Hypoaspis remilleti* sp. n. lacks setae s3 in all specimens. Gnathosoma with six rows of deutosternal denticles, setae Hyp. 3 very long, distinctly longer than remaining gnathosomal setae (fig. 7). Sternal shield hexagonal with distinct anterior border. Genital shield tongue-shaped with marginally inserted genital setae. Paranal setae always longer than postanal seta. Peritreme extends anteriorly beyond the margin of coxa I, not attached to dorsal shield. Tarsus II with two subterminal stout, blunt, spur-like setae (al_1 and pl_1, fig. 4), leg IV with macrosetae on femur (ad_1), genu (ad_1, in some species this seta might be similar in length to the remaining setae of the segment) and tarsus (ad_2, pd_2 and pd_3, fig. 6). Macrosetae are also present on femur II (pd_1) and femur III (ad_1). Leg chaetotaxy as recorded for free-living laelapids (Evans, 1963).

MALE: With long slender spermadactyl, curved distally (fig. 14). Holoventral shield with 10 pairs of setae in addition to anal setae (various degrees of erosion may separate the anal shield completely in *Hypoaspis integer*). Peritreme anteriorly fused with dorsal shield. Leg II with ventral stout, pointed, spine-like setae on femur to tarsus (fig. 38). Remaining characters as in female.

The mites are usually associated with phytophagous scarabaeids, mainly Dynastinae.

Hypoaspis neokrameri sp. n.

FEMALE: Dorsum covered by single dorsal shield (735 μm long and 445 μm wide) with 37 pairs of setae. Podonotal setae i2, s1, s4–6 are elongate and distinctly longer than the remaining podonotal setae (fig. 1). The longest dorsal setae are Z4 (220 μm), setae J5 straight and short (30 μm). The shield is nearly devoid of ornamentation. Tectum (fig. 3) triangular with denticulate proximal margins.

Tritosternum normal with pilose laciniae. Sternal shield (170 μm long and 150 μm wide at St2) well ornamented, posterior margin slightly convex and irregular (fig. 2). Sternal setae long, reaching to or beyond the bases of consecutive setae. Genital shield (distance between genital setae 105 μm) ornamented and tongue-shaped, metapodal shields narrow. Paranal setae distinctly longer than postanal seta. Peritreme extending anteriorly slightly beyond the middle of coxa I, free anteriorly and posteriorly.

Gnathosoma (fig. 7) with well-sclerotized corniculi and fimbriate internal malae. Six rows of deutosternal denticles (8–14 per row). Movable digit of chelicera (fig. 5) bidentate, fixed digit with one stout tooth and about ten small denticles.

The approximate lengths of the legs (excluding pretarsi) are: I—660 μm; II—540 μm; III—600 μm; IV—850 μm. Tarsus II (fig. 4) with two blunt distal spines, leg IV with macrosetae on the femur (220 μm), genu and tarsus (fig. 6). Macrosetae present also on femur II (150 μm) and III (110 μm). Leg chaetotaxy normal.

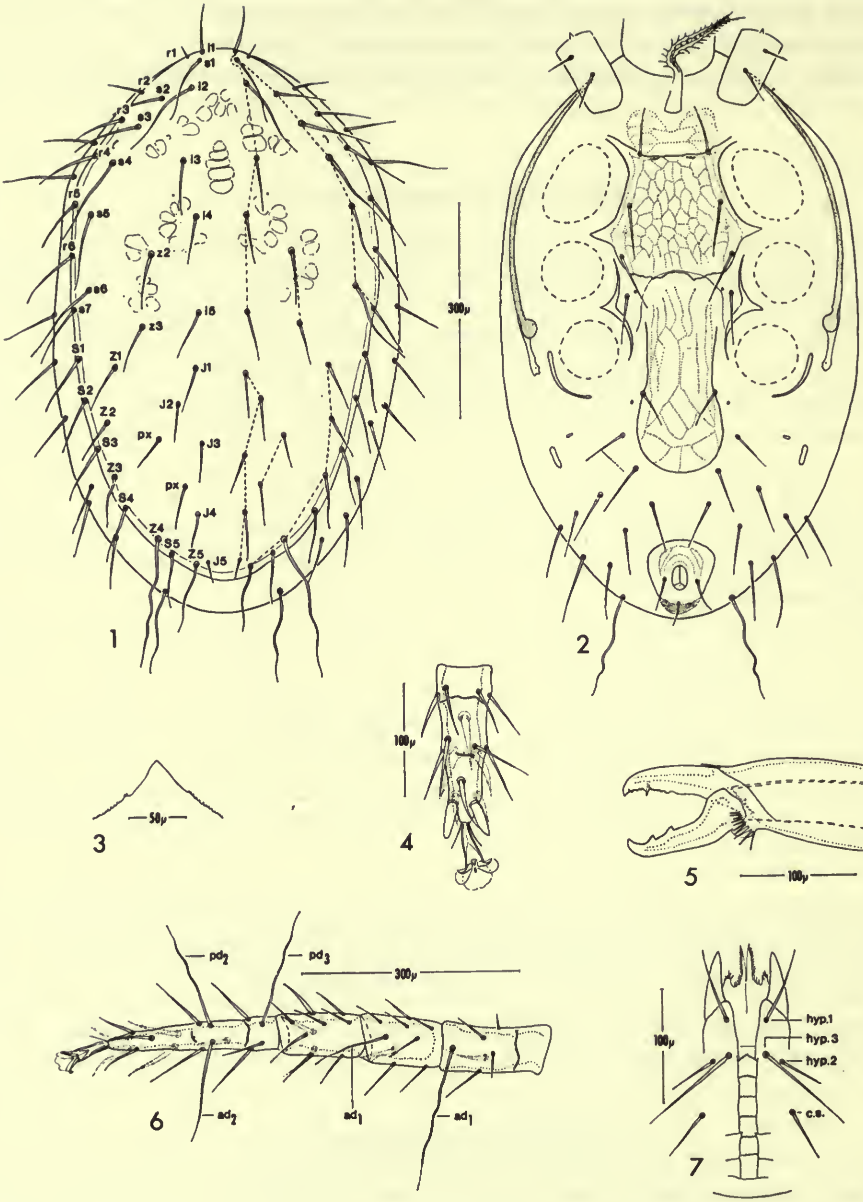
MALE: Unknown.

DIFFERENTIAL DIAGNOSIS: *H. neokrameri* sp. n. can be separated from other species of the complex by its long sternal shield which is longer than wide. Associated with *Oryctes nasicornis* L. (Scarabaeidae: Dynastinae).

MATERIAL: Holotype: ♀, ex *Oryctes nasicornis* L., Tivon, Israel, May 25, 1965, coll. M. Costa. Paratypes: 5♀♀, *ibid.*

Hypoaspis pentodoni sp. n.

FEMALE: Dorsum covered by a single dorsal shield (680 μm long and 390 μm wide) with 37 pairs of setae. Podonotal setae i2, s4–6 are elongate and distinctly longer than the remaining podonotal setae (fig. 8). The longest dorsal setae are Z4 (220 μm). The shield is nearly devoid of ornamentation, sites of muscle attachments are striated. Tectum (fig. 12) triangular with denticulate margins.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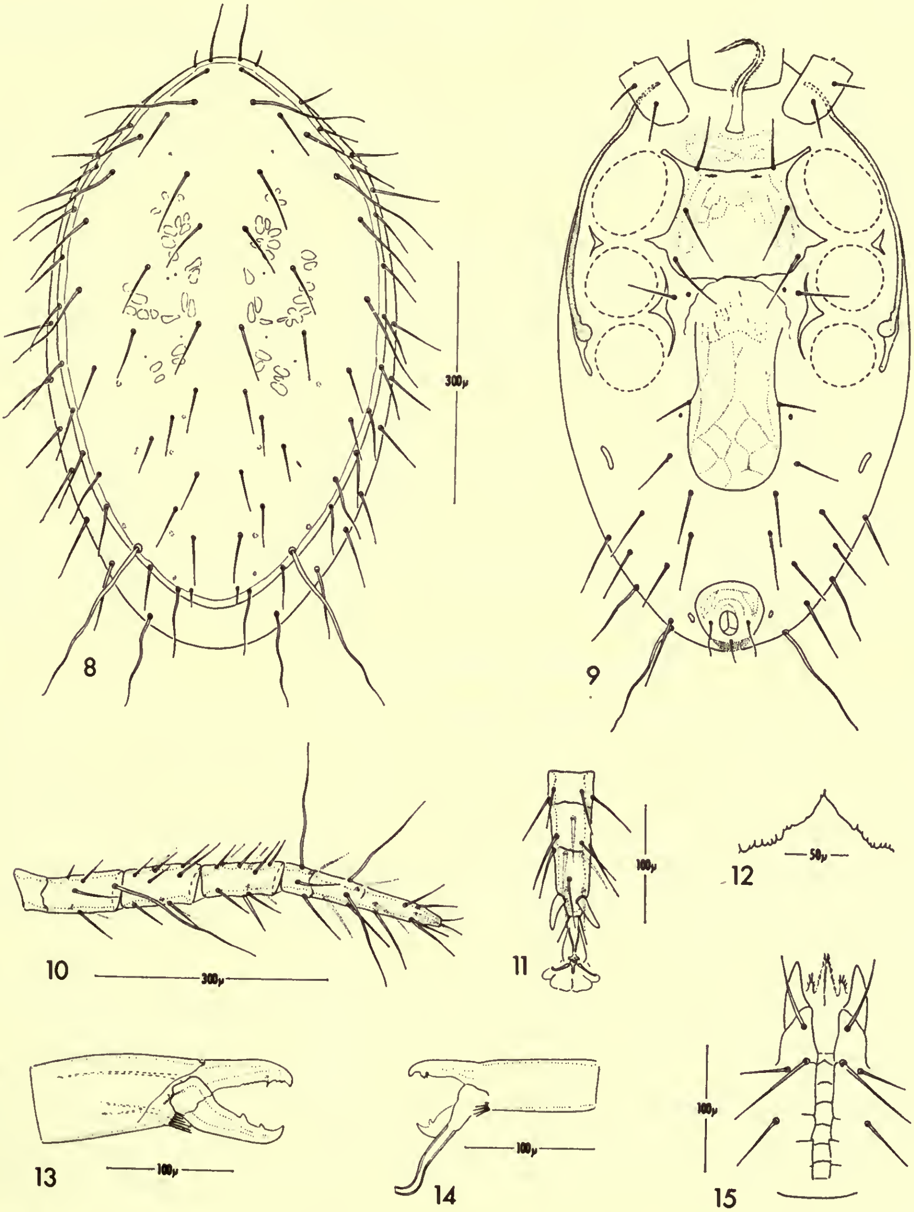
FIGS 1–7. *Hypoaspis neokrameri* sp. n., female. Fig. 1. Dorsum. Fig. 2. Venter. Fig. 3. Tectum. Fig. 4. Tarsus II. Fig. 5. Chelicera. Fig. 6. Leg IV. Fig. 7. Gnathosoma, ventral view.

Tritosternum normal with pilose laciniae. Sternal shield wider than long (125 μm long and 150 μm wide at St2), its posterior margin is nearly straight with two small but characteristic projections (fig. 9). Sternal setae long, extending beyond the



Figs 8–15. *Hypoaspis pentodoni* sp. n., female. Fig. 8. Dorsum. Fig. 9. Venter. Fig. 10. Leg IV. Fig. 11. Tarsus II. Fig. 12. Tectum. Fig. 13. Chelicera. Fig. 15. Gnathosoma, ventral view. Male. Fig. 14. Chelicera.

bases of consecutive setae. The ornamented genital shield is tongue shaped (distance between genital setae 110 µm). Metapodal shields narrow. Postanal seta distinctly shorter than paranal setae. The peritreme extends anteriorly beyond the middle of coxa I.

Gnathosoma (fig. 15) with well-sclerotized corniculi and fimbriate internal malae, six rows of tiny deutosternal denticles. Movable digit of chelicera (fig. 13) bidentate, fixed digit with small denticles.

The approximate lengths of the legs (excluding pretarsi) are: I—650 µm; II—540 µm; III—530 µm; IV—750 µm. Tarsus II (fig. 11) with two blunt distal spines. Leg IV (fig. 10) with macrosetae on femur (210 µm), genu and tarsus (*pd3*—165 µm).

MALE: The single male specimen is smaller than the female (dorsal shield 580 µm long and 330 µm wide). Venter covered by well-ornamented holoventral shield with 10 pairs of setae in addition to the anal setae. Chelicera (fig. 14) with slender, distally curved, spermadactyl. Remaining characteristics as in female, except peritreme which is attached anteriorly to the dorsal shield.

DIFFERENTIAL DIAGNOSIS: This species can be separated from *H. neokrameri* sp. n. by its short sternal shield and from *H. phyllognathi* sp. n. by its shorter dorsal setae. Associated with *Pentodon bispinosus* Küst (Scarabaeidae: Dynastinae).

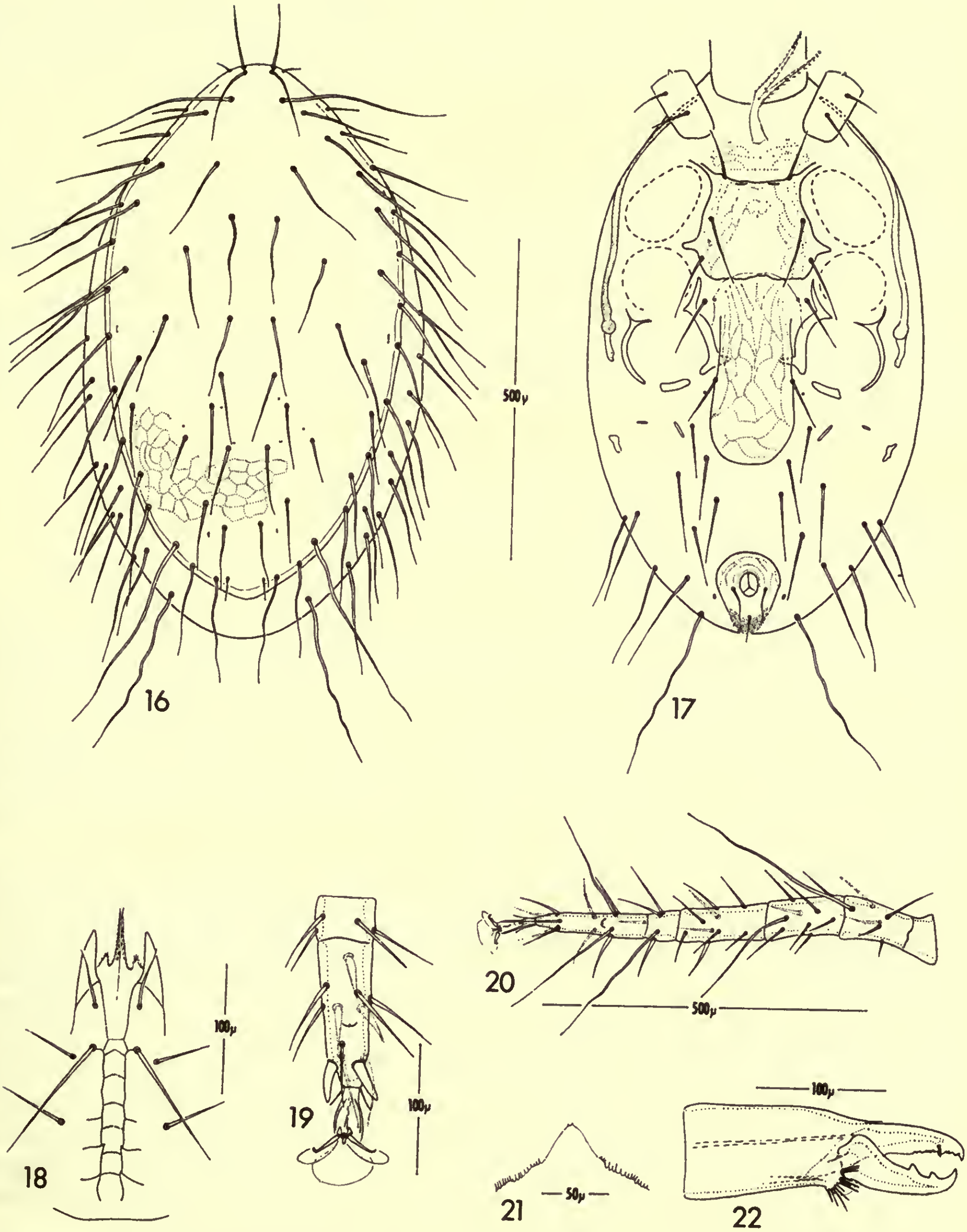
MATERIAL: Holotype: ♀ ex *Pentodon bispinosus* Küst, Mishmar Haemek, Israel, Sept. 21, 1962 coll. M. Costa. Paratypes: all from the same host and locality: 1♂, 1♀, May 19, 1965; 5♀♀, Sept. 21, 1962; 6♀♀, Sept. 12, 1966; 1♀, Nov. 8, 1965.

Hypoaspis phyllognathi sp. n.

FEMALE: Dorsum covered by single dorsal shield (840 µm long and 470 µm wide) which is ornamented with small polygons mainly in the posterior area. Regularly 37 pairs of simple setae are inserted on the shield, but in several specimens setae s3 are absent on one or both sides. Podonotal setae i2 and s4–6 are distinctly longer than the remaining podonotal setae. The longest dorsal setae are Z4 (320 µm), setae J5 straight and short (30 µm). The distribution and relative lengths of the setae are shown in fig. 16. Tectum (fig. 21) triangular, proximal margins deeply denticulate.

Tritosternum normal with pilose laciniae. Sternal shield (145 µm long and 155 µm wide at St2) well sclerotized, only faintly ornamented. Sternal setae very long, St2 extends beyond the posterior margin of the shield (fig. 17). The tongue-shaped genital shield (distance between genital setae (125 µm) has nearly parallel sides and is well ornamented. The anal shield is rounded anteriorly, the postanal seta is distinctly shorter than the paranal setae. The anal shield is flanked posteriorly by a pair of long setae. Metapodal shields small, irregular in shape. The peritreme extends anteriorly to the anterior margin of coxa I, it is free both anteriorly and posteriorly.

Gnathosoma (fig. 18) with well-sclerotized corniculi and fimbriate internal malae, with six rows of minute deutosternal denticles. Movable digit of chelicera (fig. 22)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FIGS 16–22. *Hypoaspis phyllognathi* sp. n., female. Fig. 16. Dorsum. Fig. 17. Venter. Fig. 18. Gnathosoma, ventral view. Fig. 19. Tarsus II. Fig. 20. Leg IV. Fig. 21. Tectum. Fig. 22. Chelicera.

bidentate, fixed digit with 8 small denticles in addition to a large tooth which is associated with the pilus dentilis.

The approximate lengths of the legs (excluding pretarsi) are: I—730 μm; II—570 μm; III—600 μm; IV—870 μm. Tarsus II (fig. 19) with two dorsal distal blunt spines, leg IV (fig. 20) with macrosetae on the femur (300 μm), genu (210 μm) and tarsus. Macrosetae are also present on femora II and III, leg chaetotaxy normal.

MALE: Unknown.

DIFFERENTIAL DIAGNOSIS: This species can be recognized by its long dorsal setae, its large size and by the long seta ad_1 (210 μm) on genu IV. Associated with *Phyllognathus silenus* F. (Scarabaeidae: Dynastinae).

MATERIAL: Holotype: ♀, ex *Phyllognathus silenus* F., Bardawil, Northern Sinai, April 10, 1968, beetle coll. H. Sandler. Paratypes: 13 ♀♀, same data; 6 ♀♀, Carmia, Israel, Nov. 16, 1966; 1 ♀, Tivon, Israel, May 6, 1966; 2 ♀♀, Ein Yahav, Israel, May 1, 1968.

Hypoaspis integer Berlese, 1911 sensu Samšiňák, 1960

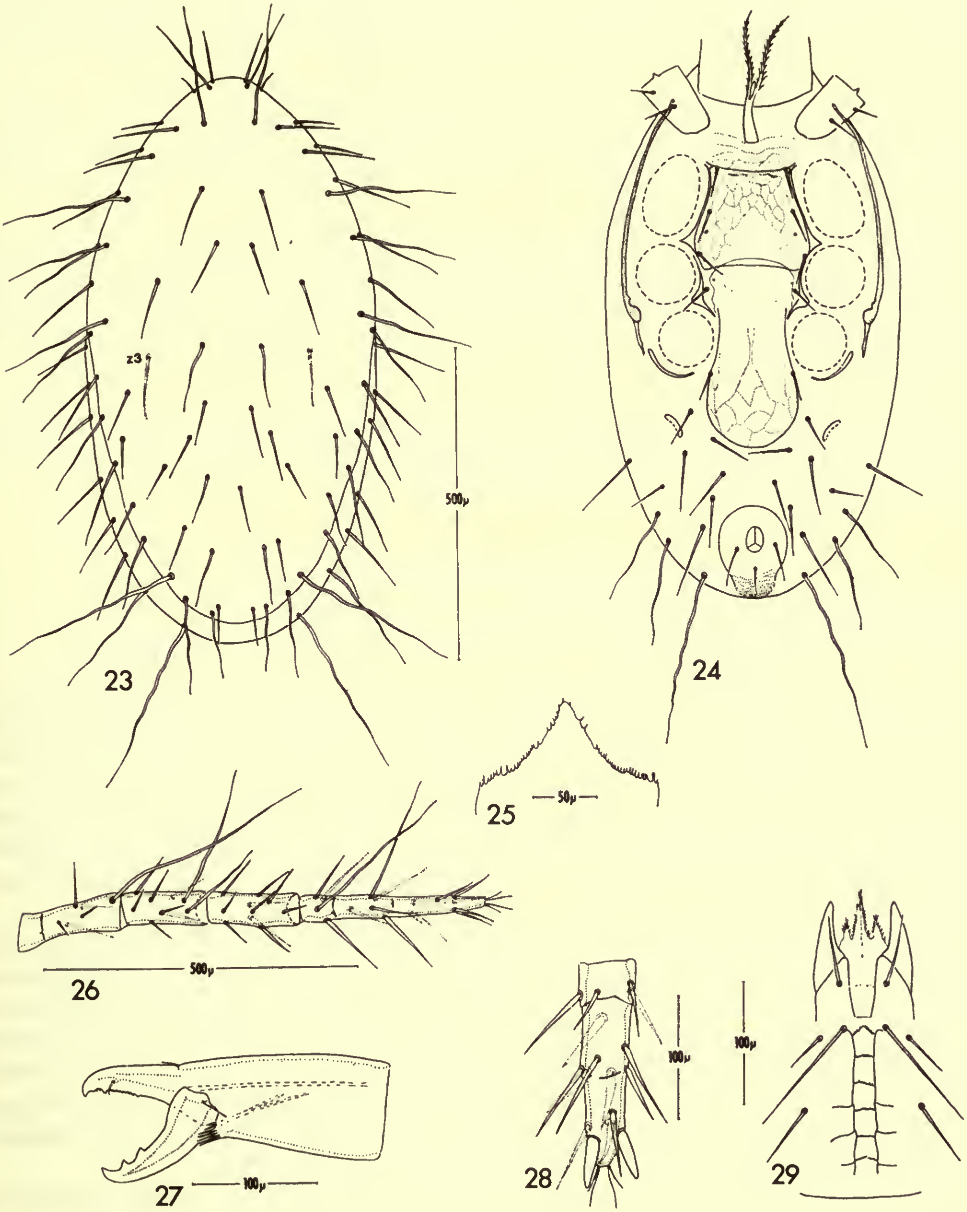
Laelaps (*Hypoaspis*) *integer* Berlese, 1911, *Redia* 7 : 186.
?*Coleolaelaps integer* Willmann, 1935, *Bull. Mus. R. Hist. nat. Belg.* 11 : 23–25, figs 14–6.
Coleolaelaps integer (male) Samšiňák, 1960, *Cas. čsl. Spol. ent.* 57 (3) : 280–82, figs 1–6.

FEMALE: Dorsum covered by single dorsal shield (820 μm long and 430 μm wide) with 36—37 pairs of setae. Of 29 investigated specimens, setae z3 were completely absent in 19 specimens, unilaterally present in 8 and bilaterally present in 2 specimens only. Podonotal setae i2, s1, s4–6 are elongate, the longest dorsal setae are Z4 (280 μm) and a pair of postero-marginal setae (200 μm) which are inserted on the soft integument. The shield is devoid of distinct ornamentation, the distribution and relative lengths of the setae are shown in fig. 23. Tectum (fig. 25) triangular with denticulate margin.

Tritosternum normal with pilose laciniae. Sternal shield (150 μm long and 150 μm wide at St2) ornamented with short sternal setae which do not reach the bases of the consecutive setae (fig. 24). Metasternal setae inserted on integument. The large genital shield (distance between genital setae 130 μm) expands slightly beyond the genital setae and is ornamented. Metapodal shields narrow, kidney-shaped. Anal shield with semicircular anterior border, postanal seta distinctly shorter than paranal setae. The anal shield is flanked posteriorly by a pair of long (300 μm) setae. The narrow peritreme extends anteriorly to the middle of coxa I.

Gnathosoma (fig. 29) with well-sclerotized corniculi and fimbriate internal malae, six rows of tiny deutosternal denticles (about 12 per row). Movable digit of chelicera (fig. 27) bidentate, fixed digit with one large tooth and about 10 sub-equal small denticles.

The approximate lengths of the legs (excluding pretarsi) are: I—680 μm; II—620 μm; III—580 μm; IV—960 μm. Tarsus II (fig. 28) with two dorsal distal blunt spines, with ventral setae markedly stouter than the dorsal setae. Leg IV (fig. 26) with macrosetae on femur (360 μm), on the genu (*ad*1—250 μm, *pd*1—180 μm) and tarsus; macrosetae are also present on femur II (270 μm) and III (260 μm). Leg chaetotaxy normal for the genus.


z3
500μ
23
24
25
50μ
500μ
26
100μ
27
100μ
28
100μ
29

Figs 23–29. *Hypoaspis integer* Berlese, female. Fig. 23. Dorsum. Fig. 24. Venter. Fig. 25. Tectum. Fig. 26. Leg IV. Fig. 27. Chelicera. Fig. 28. Tarsus II. Fig. 29. Gnathosoma, ventral view.

MALE: The male has been described by Samšiňák (1960). The ventral sclerotization is extremely variable, out of 14 male specimens only one had a complete holoventral shield, in one specimen this was eroded but the anal shield was still broadly connected to the ventral shield and in 12 specimens, with variously shaped genitoventral shields, the anal shield was completely separate. In the males the corresponding macrosetae are longer than in the females.

DIFFERENTIAL DIAGNOSIS: The long macrosetae on femora II and III, as well as the two macrosetae on genu IV are good diagnostic characters for this species. Associated with *Oryctes nasicornis* L. (Scarabaeidae: Dynastinae) and *Polyphylla fullo* L. (Scarab.: Melolonthinae).

NOTES: The original association seems to be with *O. nasicornis*, the association with *P. fullo* appears to be secondary (vide Costa & Hunter, in press). The specimens ex *P. fullo* (the beetles were kindly loaned by the American Museum of Natural History) were collected from beneath the elytra by methods described by Costa & Hunter (op. cit.).

MATERIAL: 2 ♂♂, 28 ♀♀, ex *Oryctes nasicornis*, Bohemia, Liblice, July 16, 1960, coll. and det. K. Samšiňák; 5 ♂♂, 53 ♀♀ *Polyphylla fullo*, S. Russia; 3 ♂♂, 41 ♀♀, *ibid.*, Prussia; 4 ♂♂, 56 ♀♀, *ibid.*, Germany, 1897.

Hypoaspis rhinocerotis Oudemans, 1925

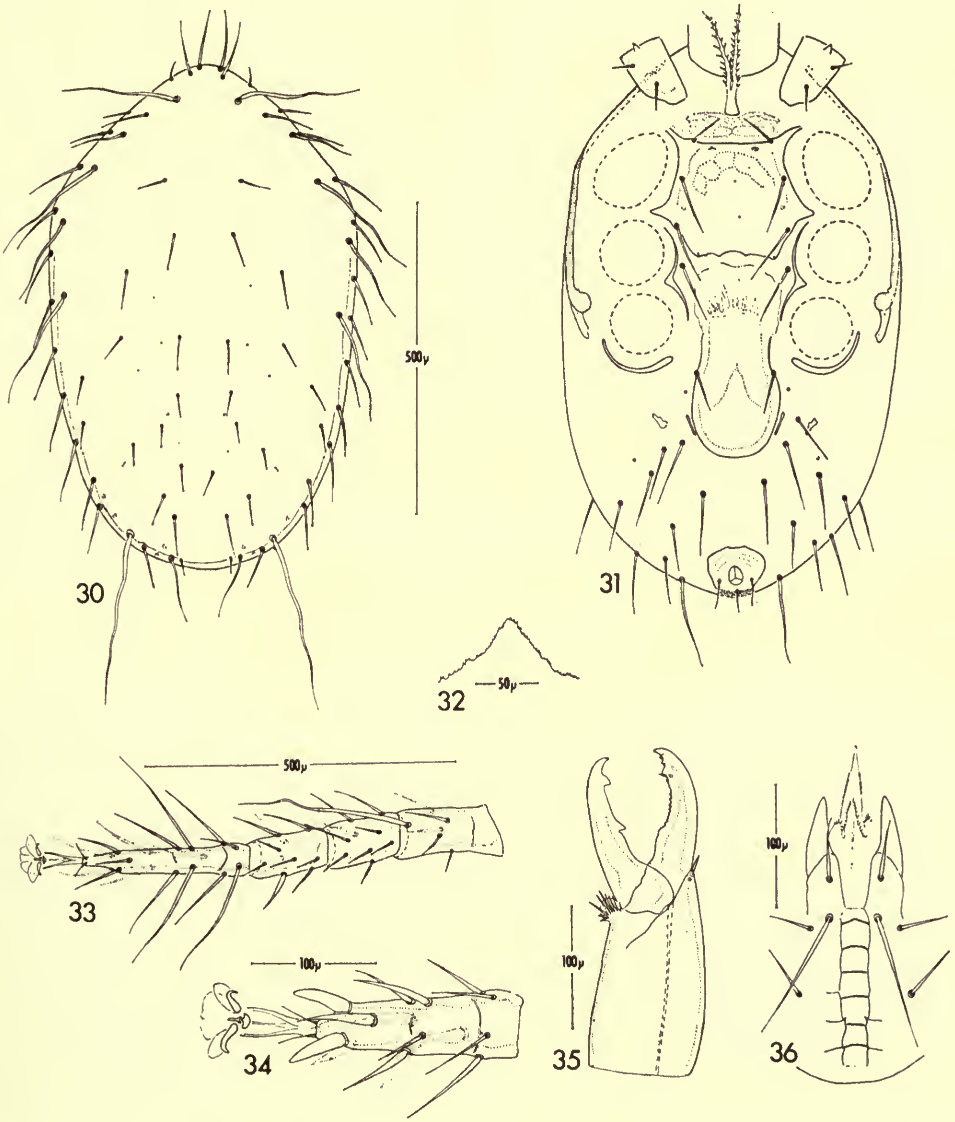
Hypoaspis rhinocerotis Oudemans, 1925, *Ent. Ber., Amst.* 7 (146) : 30.
Coleolaelaps rhinocerotis Oudemans, 1927, *Zoöl. Meded. Leiden* 10 (4) : 189–193, figs 8–15.

FEMALE: Dorsum covered by a single dorsal shield (770–830 μm long and 470–540 μm wide), with 37 pairs of simple setae. Setae s1 subequal in length with vertical setae (i1); the longest podonotal setae being i2, s4–6 (s5 being shorter than either s4 or s6). The central dorsal setae, especially on the opisthonotum are short and do not extend to the bases of the consecutive setae. Setae Z4 are the longest dorsal setae (300 μm), setae J5 are short (30 μm). The distribution and the relative lengths of the setae are shown in fig. 30. Tectum (fig. 32) triangular with denticulate margin.

Tritosternum normal with well developed laciniae. Sternal shield (170 μm long and 185 μm wide at St2) only slightly ornamented. St1 distinctly shorter than St2–4 which are long and extend markedly beyond the bases of the consecutive setae (fig. 31). The posterior margin of the shield is irregular. Genital shield (distance between genital setae 130 μm) tongue-shaped and nearly devoid of ornamentation. Metapodal shields narrow and irregular. Anal shield small, postanal seta distinctly shorter than paranal setae. Peritreme extends anteriorly slightly beyond the middle of coxa I, it is free anteriorly and posteriorly.

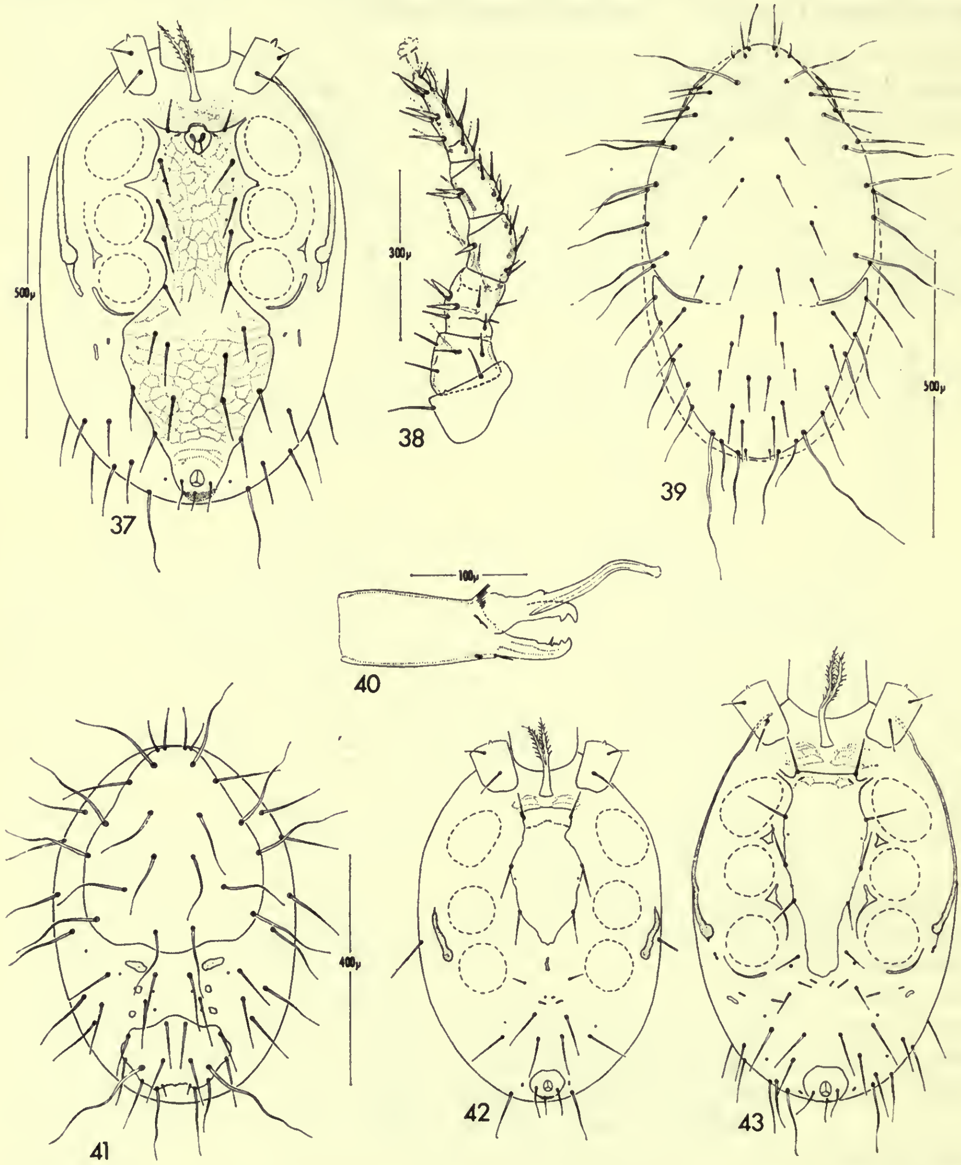
Gnathosoma (fig. 36) with well-sclerotized corniculi and fimbriate internal malae, six rows of deutosternal denticles (12–18 per row). Chelicera (fig. 35) with bidentate movable digit with a large distance between the two teeth, fixed digit slightly curved and sickle shaped with one stout tooth and about 12 small denticles.

The approximate lengths of the legs (excluding pretarsi) are: I—750 µm; II—660 µm; III—700 µm; IV—950 µm. Tarsus II (fig. 34) with two dorsal blunt spines, its ventral setae being much stouter than its dorsal setae. Leg IV (fig. 33) with macrosetae on femur (270 µm) and tarsus only, ad_1 of the genu being only slightly longer than the remaining setae on the segment. Macrosetae are present also on femora II and III. Leg chaetotaxy normal.



FIGS 30–36. *Hypoaspis rhinocerotis* Oudemans, female. Fig. 30. Dorsal shield. Fig. 31. Venter. Fig. 32. Tectum. Fig. 33. Leg IV. Fig. 34. Tarsus II. Fig. 35. Chelicera. Fig. 36. Gnathosoma, ventral view.

MALE: Dorsal shield smaller (740 μm long and 480 μm wide) than in female, with the same chaetotaxy. The venter (fig. 37) is covered by a well-ornamented holoventral shield with 10 pairs of setae in addition to the regular anal setae. Remaining ventral features as in female.



FIGS 37–43. *Hypoaspis rhinocerotis* Oudemans. Male, Fig. 37. Venter. Fig 38. Leg II. Fig. 40. Chelicera. Deutonymph. Fig. 39. Dorsal shield. Fig. 43. Venter. Protonymph. Fig. 41. Dorsum. Fig. 42. Venter.

Movable digit of chelicera (fig. 40) monodentate with long slender spermadactyl which is distally curved. Fixed digit with about 4 teeth. Leg chaetotaxy as in female, leg II (fig. 38) with several stout pointed spine-like setae on femur to tarsus, similar to the condition found in *H. krameri* (as figured by Evans & Till, 1966).

DEUTONYMPH: Dorsal shield (670 μm long and 380 μm wide) deeply incised laterally, chaetotaxy and other features as in female although several central setae are longer (fig. 39). Sternal shield (fig. 43) extends only slightly beyond the posterior margin of coxa IV. A number of small platelets are present on the integument. Remaining characters as in female.

PROTONYMPH: The idiosoma (660 μm long) is covered by two dorsal shields and three pairs of platelets in the mesonotal region. The podonotal shield (365 μm long and 325 μm wide) with 11 pairs of long setae all of which extend beyond the bases of consecutive setae. The opisthonotal shield with 8 pairs of setae, S5, Z4–5 and J5 having the same relative lengths as in the adult. The distribution and relative lengths of the setae are shown in fig. 41. The venter (fig. 42) with a sternal shield with 3 pairs of setae. Peritremes rudimentary.

DIFFERENTIAL DIAGNOSIS: The short central dorsal setae and the large sickle-shaped chelicera separate *H. rhinocerotis* from the preceding species. Associated with *Oryctes rhinoceros* L. (Scarabaeidae: Dynastinae).

MATERIAL: Numerous specimens, ex *Oryctes rhinoceros*, Apia, W. Samoa, July, 1969; additional specimens from eggs of *O. rhinoceros* and laboratory cultures. All the specimens were made available through the courtesy of Mr B. Zelazny and Dr M. J. Stelzer.

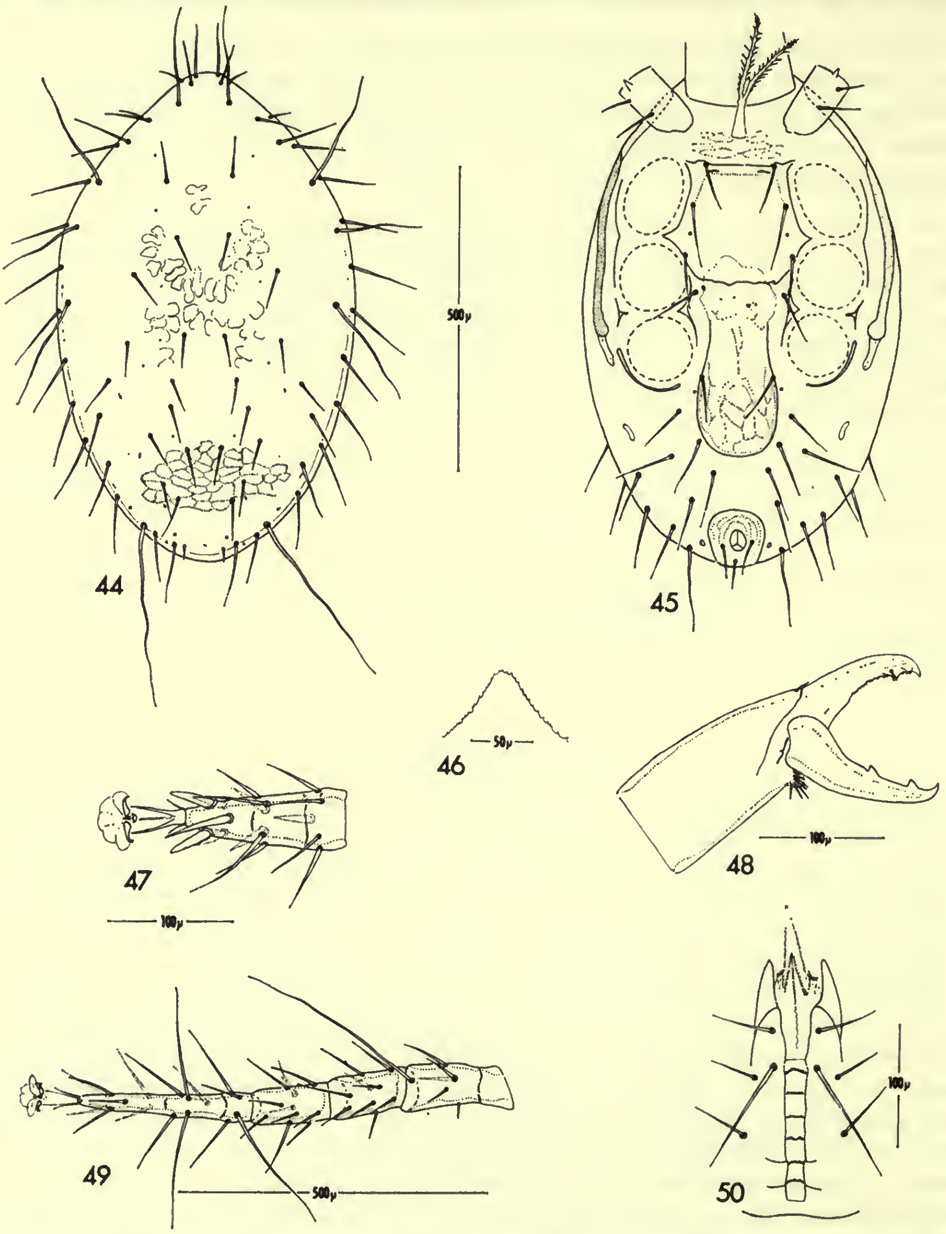
Hypoaspis athiasae sp. n.

FEMALE: Dorsal shield (770–820 μm long and 490–510 μm wide) covers most of the dorsum, with 37 pairs of setae. The shield is slightly ornamented, mainly on its posterior part. Setae i2, s4–6 are the longest podonotal setae, s5 being markedly shorter than either s4 or s6. Setae Z4 are the longest dorsal setae (280 μm), J5 are short (30 μm). The distribution and the relative lengths of the setae are shown in fig. 44. Tectum (fig. 46) triangular with denticulate margin.

Tritosternum with well-developed laciniae. Sternal shield (195 μm long and 175 μm wide at St2) without apparent ornamentation, with long sternal setae which extend beyond the base of the consecutive setae. Posterior margin of shield nearly straight and slightly irregular. Genital shield (distance between genital setae 120 μm) tongue-shaped and well ornamented. Narrow, kidney-shaped metapodal shields. The wide peritreme extends anteriorly to the anterior margins of coxa I. The postanal seta is shorter than the paranal setae.

Gnathosoma (fig. 50) with well-sclerotized corniculi and fimbriate internal malae, with six rows of deutosternal denticles (10–14 per row). Movable digit of chelicera (fig. 48) bidentate, fixed digit with about 14 small denticles in addition to a larger tooth which is associated with the pilus dentilis.

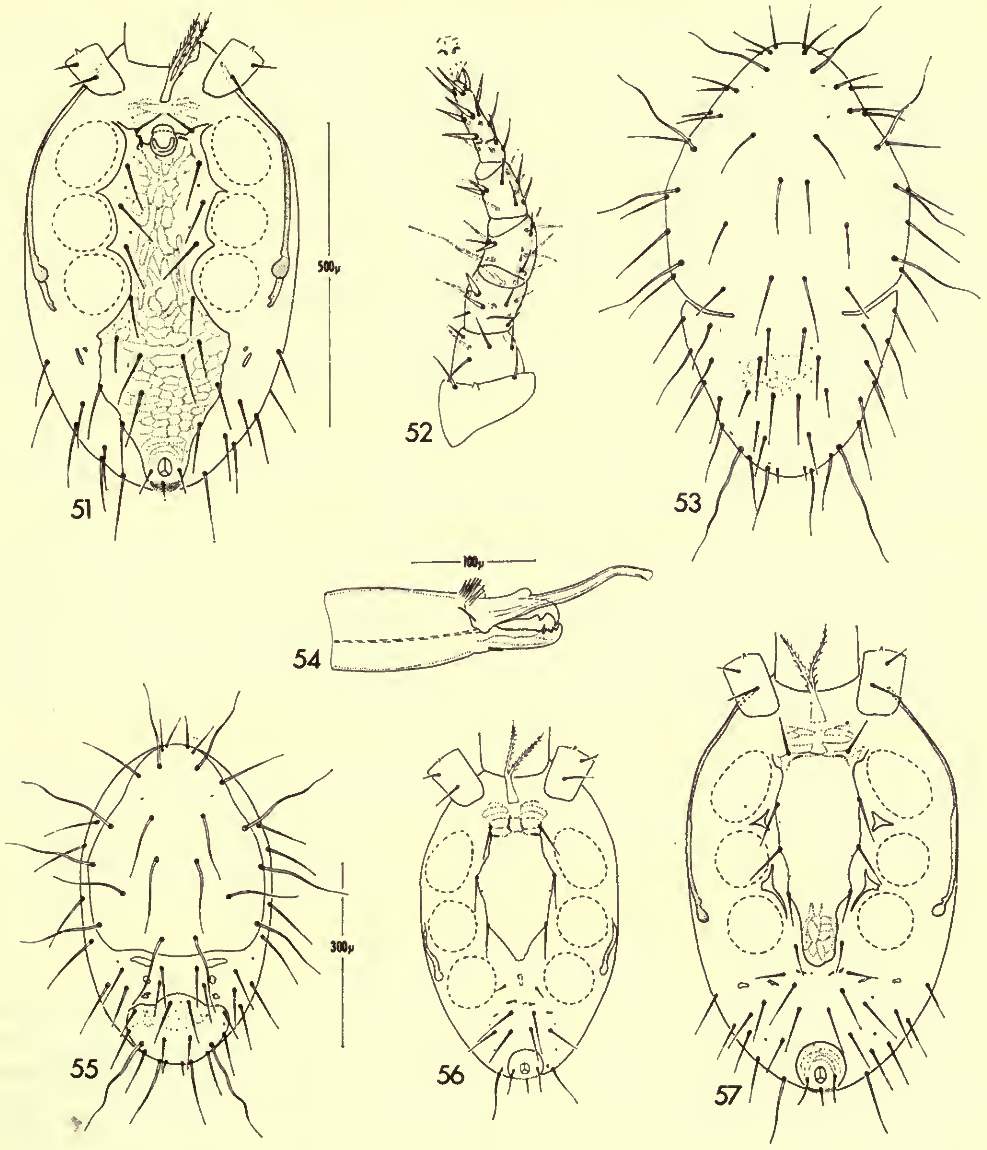
The approximate lengths of the legs (excluding pretarsi) are: I—840 μm; II—675 μm; III—710 μm; IV—800 μm. Tarsus II (fig. 47) with two dorsal distal blunt spines. Leg IV (fig. 49) with macrosetae on femur (280 μm) and tarsus


44
500μ
45
46
50μ
47
100μ
48
100μ
49
500μ
50
100μ

FIGS 44–50. *Hypoaspis athiasae* sp. n., female. Fig. 44. Dorsal shield. Fig. 45. Venter. Fig. 46. Tectum. Fig. 47. Tarsus II. Fig. 48. Chelicera. Fig. 49. Leg IV. Fig. 50. Gnathosoma, ventral view.

only, ad_1 of the genu being only slightly longer than the remaining setae of the segment. Macrosetae also present on femora II and III.

MALE: The dorsal shield (815 μm long and 485 μm wide) and chaetotaxy as in female. Ventrally the idiosoma is covered by a well-ornamented holoventral



FIGS 51–57. *Hypoaspis athiasae* sp. n. Male, Fig. 51. Venter. Fig. 52. Leg II. Fig. 54. Chelicera. Deutonymph, Fig. 53. Dorsal shield. Fig. 57. Venter. Protonymph, Fig. 55. Dorsum. Fig. 56. Venter.

shield, usually with 10 pairs of setae in addition to the regular anal setae (fig. 51). The extent and outlines of the shield may vary asymetrically and with it the chaetotaxy. The chelicera (fig. 54) with monodentate movable digit which bears a long slender spermadactyl, slightly curved distally. Leg II with pointed spine-like setae on femur to tarsus (fig. 52), similar to the condition in *H. krameri* (Evans & Till, op. cit.).

Deutonymph: Dorsal shield (715 µm long and 400 µm wide) deeply incised laterally. Chaetotaxy similar to that of the female, central setae (mainly i series) noticeably long. The shield is faintly ornamented mainly on its posterior portion. The distribution and relative lengths of the setae is shown in fig. 53. The anal shield is rounded and the postanal seta is markedly shorter than the paranal setae (fig. 57).

Protonymph: The idiosoma (530 µm long) is covered by two dorsal shields and three pairs of platelets in the mesonotal region. The podonotal shield (350 µm long and 290 µm wide) with 11 pairs of long setae. The opisthonotal shield (120 µm long and 170 µm wide) with 8 pairs of setae. Setae S5, Z4–5 and J5 have the same relative lengths as in the adult. The distribution and the relative lengths of the setae are shown in fig. 55. The venter (fig. 56) with small sternal shield which has a very indistinct anterior margin.

Differential diagnosis: This species is closely related to *H. rhinocerotis* from which it can be separated mainly by its longer central dorsal setae, a character which is even more conspicuous in the deutonymph.

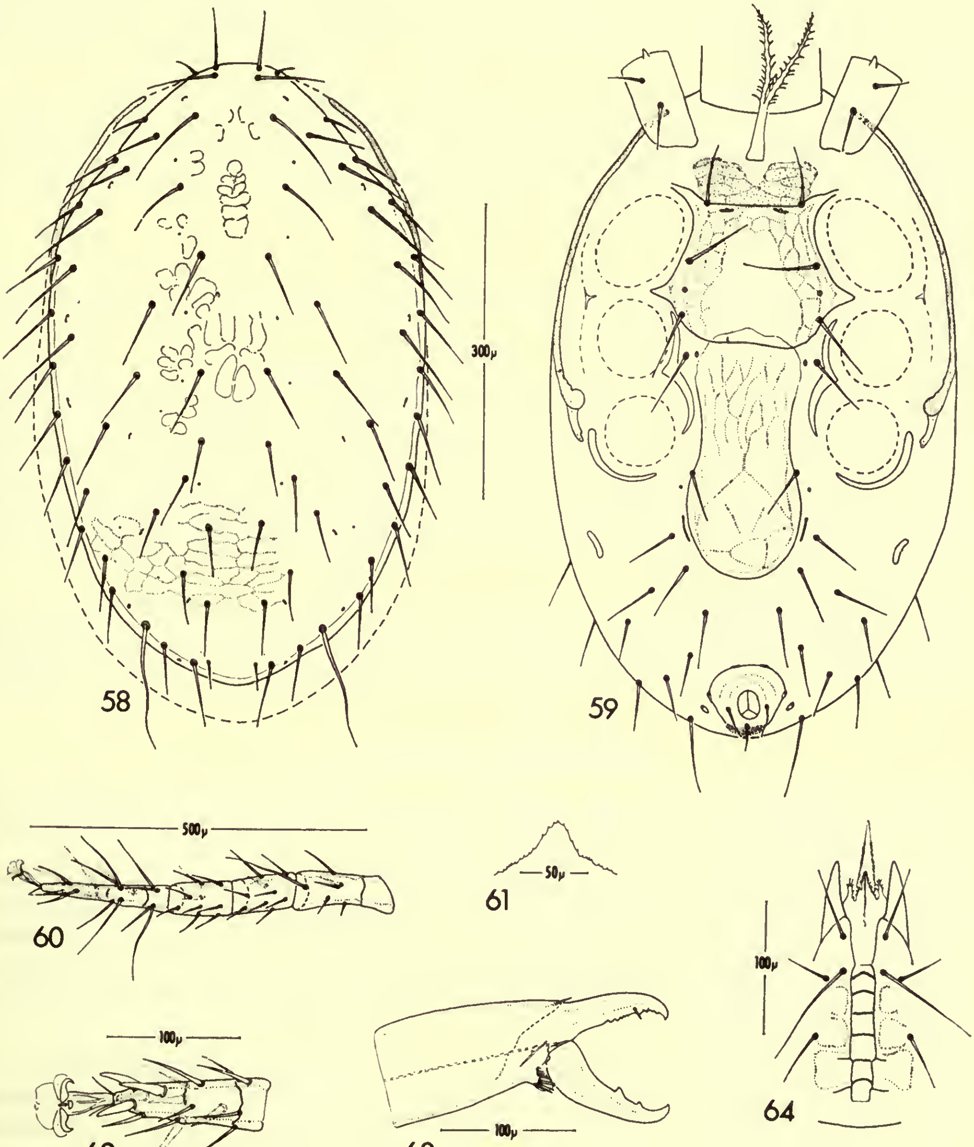
Notes: This species has been collected in large numbers (by Dr C. Athias-Henriot) from soil as well as from eggs of *O. monoceros* in the Ivory Coast. It is well known that many dynastine beetles emerge from their puparia during a few days of the year only, usually for a short time before dusk. It may well be that the possibility to collect a large number of the mites from the soil happened after a mass emergence of the beetles which are probably their normal host.

Material: Holotype: ♀, ex humid soil (Aerodrome), Ivory Coast, July 18, 1969, coll. C. Athias-Henriot. Paratypes: 1 ♂ and numerous female specimens *ibid.*; 5 ♀♀ *Oryctes monoceros*, Ivory Coast, 1969.

Hypoaspis dubius sp. n.

Female: Dorsum covered by a single dorsal shield (640 µm long and 380 µm wide), with 37 pairs of simple setae. The shield is finely ornamented mainly on its posterior part. Setae i2, s1 and s4–6 are longer than the remaining podonotal setae, the longest dorsal setae are Z4 (130 µm), the shortest J5 (25 µm). Nearly all the central setae are long and extend beyond the base (or the horizontal level of the bases) of the consecutive setae. The distribution and the relative lengths of the setae are shown in fig. 58. Tectum (fig. 61) triangular with denticulate margin.

Tritosternum normal with pilose laciniae. Sternal shield (135 µm long and 140 µm wide at St2) faintly ornamented mainly in its anterior and lateral parts, posterior margin slightly concave to nearly straight. St1 shorter than remaining sternal setae which are long and extend beyond the base of consecutive setae. The tongue-



Figs 58–64. *Hypoaspis dubius* sp. n., female. Fig. 58. Dorsal shield. Fig. 59. Venter. Fig. 60. Leg IV. Fig. 61. Tectum. Fig. 62. Tarsus II. Fig. 63. Chelicera. Fig. 64. Gnathosoma, ventral view.

shaped genital shield (distance between genital setae 105 μm) is faintly ornamented (fig. 59). Metapodal shields narrow and elongate. The postanal seta is shorter than the paranal setae. The peritreme extends anteriorly slightly beyond the middle of coxa I.

Gnathosoma (fig. 64) with well-sclerotized corniculi and fimbriate inner malae, six rows of deutosternal denticles (14–18 per row). Movable digit of chelicera (fig. 63) bidentate, fixed digit with about 8 small denticles in addition to one larger tooth.

The approximate lengths of the legs (excluding pretarsi) are: I—640 μm; II—490 μm; III—490 μm; IV—690 μm. Tarsus II (fig. 62) with two dorsal distal blunt spines. Leg IV (fig. 60) with macrosetae on the femur (145 μm) and tarsus only. Macrosetae are present also on femora II and III.

MALE: Unknown.

DIFFERENTIAL DIAGNOSIS: This species is characterized by its small size and short Z4 and ad_1 of femur IV.

NOTES: The status of this species is uncertain and it might be a hybrid. Originally it was introduced from the Ivory Coast, ex *Oryctes monoceros*. It has become established in W. Samoa and occurred together with *H. rhinocerotis* on a field-collected *O. rhinoceros* (coll. Dr M. J. Stelzer). In view of the fact that *Hypoaspis athiasae* sp. n. has also been collected from *O. monoceros*, a misdetermination of the African host cannot be ruled out, since over a dozen species of *Oryctes* exist in central and western Africa.

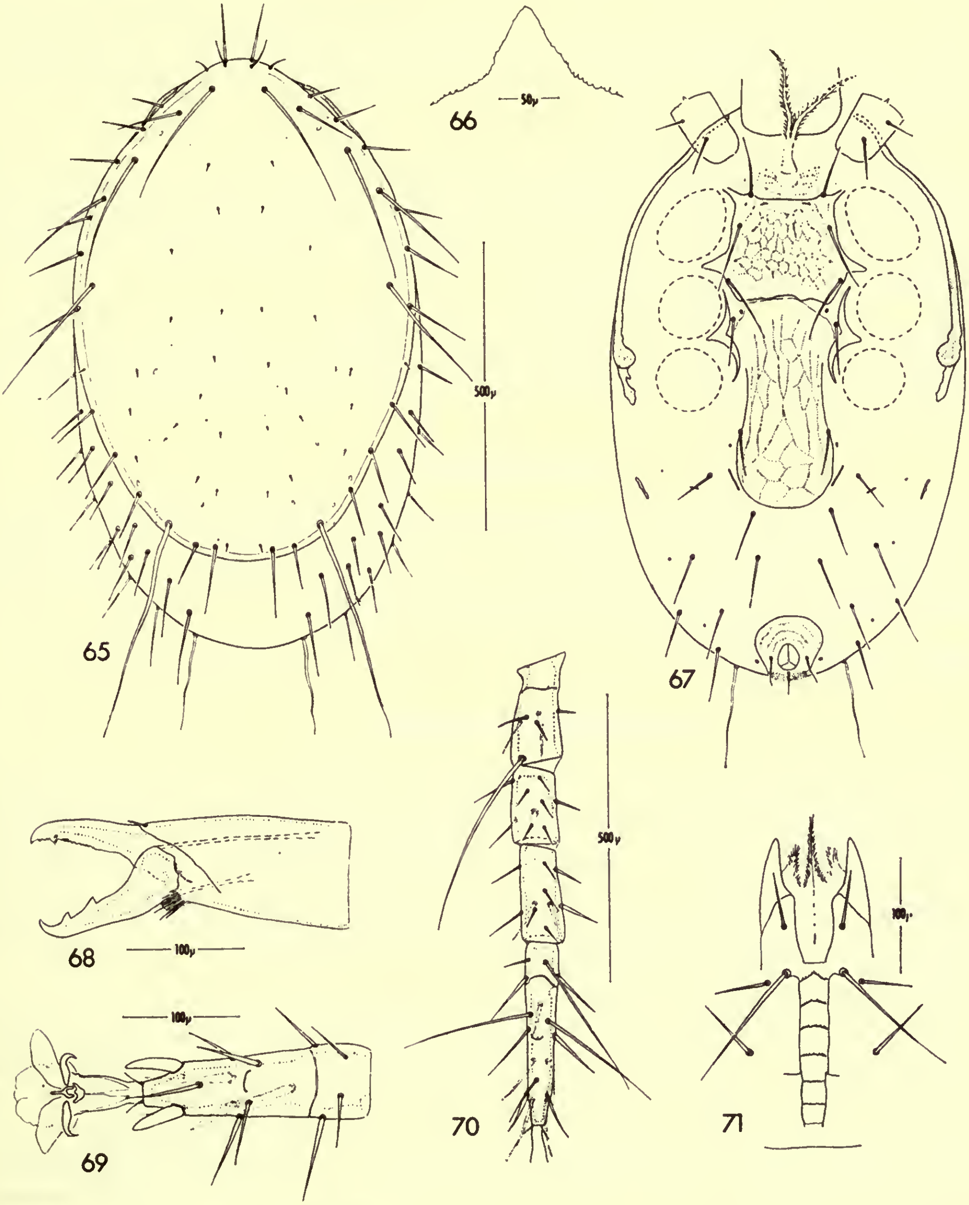
MATERIAL: Holotype: ♀, laboratory reared, Apia, W. Samoa, July 1969, laboratory colony started from specimens ex *Oryctes monoceros*, Ivory Coast. Paratypes: many *ibid.*; 6 ♀♀, *O. rhinoceros*, Apia, W. Samoa, Sept. 1969, coll. Dr M. J. Stelzer.

Hypoaspis remilleti sp. n.

FEMALE: Dorsum covered by single dorsal shield (870 μm long and 560 μm wide) leaving a wide strip of uncovered integument. The shield bears 36 pairs of setae (s3 missing, compare *Hypoaspis phyllognathi* sp. n.) of three different types: minute setae (about 20 μm long: i3–5, z2–3, J series px2–3, Z1–3 and S1); extremely long setae (i2, s4–6 and Z4 which are 400 μm long) and 'normal' marginal setae. The posterior elongate integumental setae are only 180 μm long. The distribution and the relative lengths of the setae are shown in fig. 65. Tectum (fig. 66) triangular with denticulate margin.

Tritosternum normal with pilose laciniae. Sternal shield (160 μm long and 170 μm wide at St2) ornamented, with irregular posterior margin (fig. 67). The sternal setae are long, extending beyond the bases of the consecutive setae. The well-ornamented genital shield (distance between genital setae 150 μm) expands slightly beyond coxae IV. Anal shield with round anterior margin, postanal seta shorter than paranal setae. The peritreme extends anteriorly to or slightly beyond the anterior margin of coxa I, it is free both anteriorly and posteriorly.

Gnathosoma (fig. 71) with well-sclerotized corniculi and fimbriate internal malae, six rows of minute deutosternal denticles. Movable digit of chelicera (fig. 68) bidentate, fixed digit with about 12 small denticles in addition to one larger tooth.



FIGS 65–71. *Hypoaspis remilleti* sp. n., female. Fig. 65. Dorsum. Fig. 66. Tectum. Fig. 67. Venter. Fig. 68. Chelicera. Fig. 69. Tarsus II. Fig. 70. Leg IV. Fig. 71. Gnathosoma, ventral view.

The approximate lengths of the legs (excluding pretarsi) are: I—890 µm; II—740 µm; III—800 µm; IV—1100 µm. Tarsus II (fig. 69) with two blunt dorsal subterminal spines. Leg IV (fig. 70) with macrosetae on the femur (380 µm) and tarsus only. Leg chaetotaxy normal.

MALE: Dorsal shield as in female. The venter is covered by a holoventral shield with 10 pairs of setae in addition to the regular anal setae. Leg II with pointed spine-like ventral setae on femur to tarsus. Chelicera with slender spermodactyl, distally curved.

DIFFERENTIAL DIAGNOSIS: This species can be easily recognized by its very short central setae and its long antero-lateral setae. It differs from closely related '*Coleolaelaps*' *proximus* Cooreman, 1948 mainly in the shape of the sternal shield which is markedly longer than wide in *C. proximus*. Associated with *Heteroligus meles* Billb. (Scarabaeidae: Dynastinae).

MATERIAL: Holotype: ♀, ex *Heteroligus meles* Billb., nr. Abidjan, Ivory Coast, 1969, coll. Dr M. Remillet. Paratypes: numerous specimens including males with the same data.

Lucanaspis gen. n.

General facies of female as in *Hypoaspis* with the following differences: Thirty-three pairs of dorsal setae of which i2, s4 and Z4 are very long. Sternal shield markedly wider than long. Legs stumpy and shorter than length of dorsal shield. Tarsus II with two subterminal stout and pointed setae.

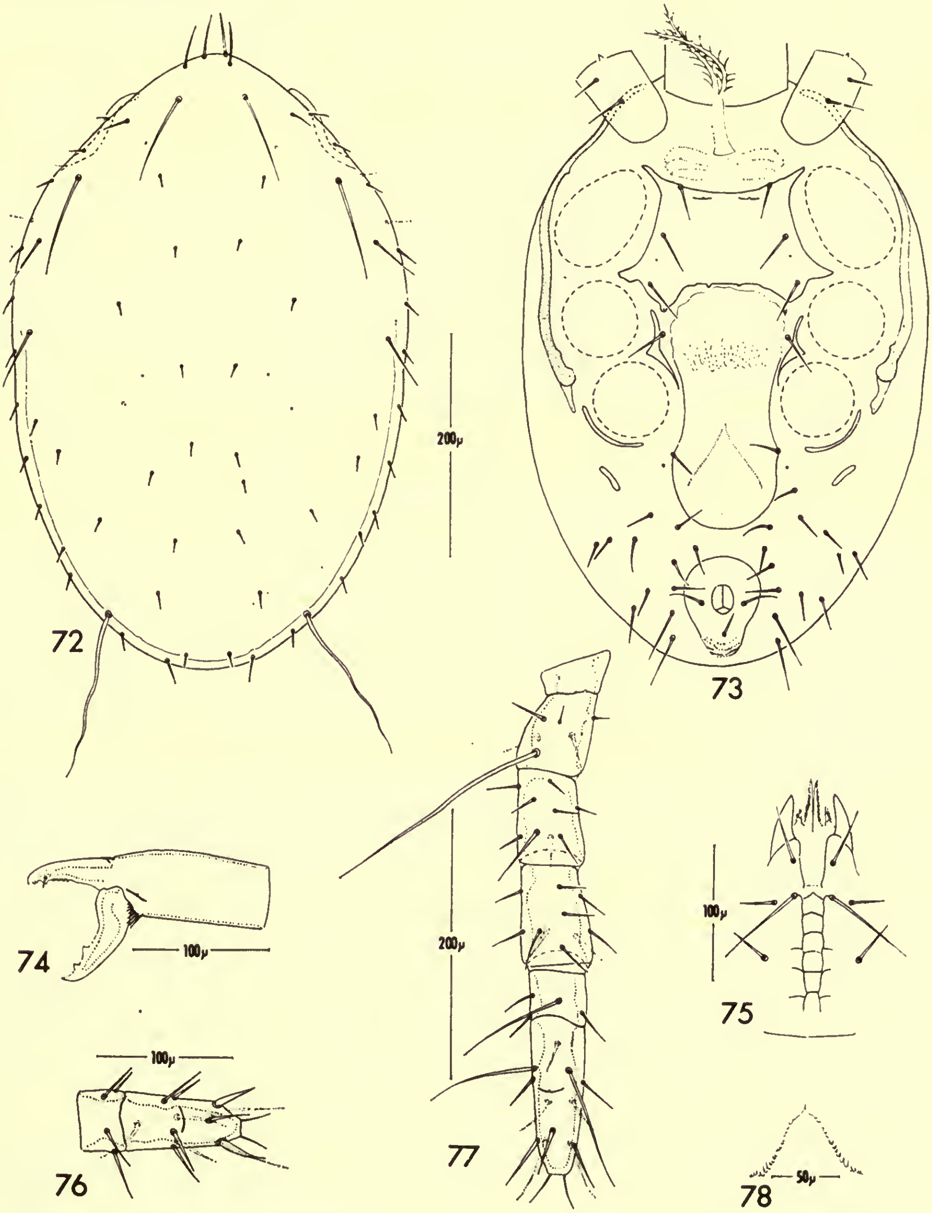
MALE: Unknown.

Lucanaspis brachypedes sp. n.

FEMALE: Dorsum covered by a single dorsal shield (545 µm long and 360 µm wide), devoid of ornamentation, with 33 pairs of simple setae. The podonotal setae (17 pairs) are very short (10–15 µm) with the exception of i1 and s1 (85 µm), i2, s4 (120 µm), s5 and s6 (60 µm). The opisthonotal setae (16 pairs) are short with the exception of Z4 (155 µm) which are the longest dorsal setae. The distribution and the relative lengths of the setae are shown in fig. 72. Tectum (fig. 78) triangular with denticulate margins.

Tritosternum normal with pilose laciniae. Sternal shield (75 µm long and 130 µm wide at St2) with distinct anterior concave margin and slightly irregular concave posterior margin. The shield is devoid of distinct ornamentation. The first sternal pores are very large and close to each other. Metasternal setae inserted on the integument, the associated pore may be incorporated into the sternal shield (fig. 73). Genital shield (distance between genital setae 95 µm) broad and tongue-shaped. Anterior margin of anal shield semicircular, paranal setae slightly longer than postanal seta. The shield is flanked by two pairs of slightly longer and stouter ventral setae. Metapodal shields elongate, oval. The peritreme extends anteriorly nearly to the anterior margin of coxa I, it is free both anteriorly and posteriorly.

Gnathosoma (fig. 75) with well-sclerotized corniculi and fimbriate internal malae, with six rows of tiny deutosternal denticles. Movable digit of the chelicera (fig. 74) bidentate, fixed digit with three medium sized distal teeth and about seven small proximal denticles.



FIGS 72–78. *Lucanaspis brachypedes* gen. n., sp. n., female. Fig. 72. Dorsal shield. Fig. 73. Venter. Fig. 74. Chelicera. Fig. 75. Gnathosoma, ventral view. Fig. 76. Tarsus II. Fig. 77. Leg IV. Fig. 78. Tectum.

The approximate lengths of the legs (excluding pretarsi) are: I—520 µm; II—450 µm; III—440 µm; IV—540 µm. Leg chaetotaxy normal as in free-living laelapids. Macrosetae are present on femora II–IV (on femur IV—165 µm) and tarsus IV (fig. 77). Tarsus II (fig. 76) with two subterminal pointed stout setae.

MATERIAL: Holotype: ♀, ex lucanid beetle, nr. Abidjan, Ivory Coast, Oct. 1969, coll. Dr M. Remillet. Paratypes: 8 ♀♀, same data.

Dynastaspis gen. n.

General facies of female as in *Hypoaspis* with the following differences: 32 pairs of dorsal setae (18 podonotal and 14 opisthonotal) with s4–6 and Z4 very long and 'wavy'. Tectum with nondenticulate margin. Four macrosetae of a different homology on tarsus IV: ad_2, al_3, pl_2 and pd_3 (instead of pd_2, pd_3 and ad_2 in *Hypoaspis* s. str.), pd_2 being proximally inserted to ad_2 (as distinct from being at the same level in *Hypoaspis* s. str.). Tarsus II with two subterminal pointed stout setae. Ornamentation of genital shield different from that found in *Hypoaspis*.

MALE: Unknown.

Dynastaspis walhallae sp. n.

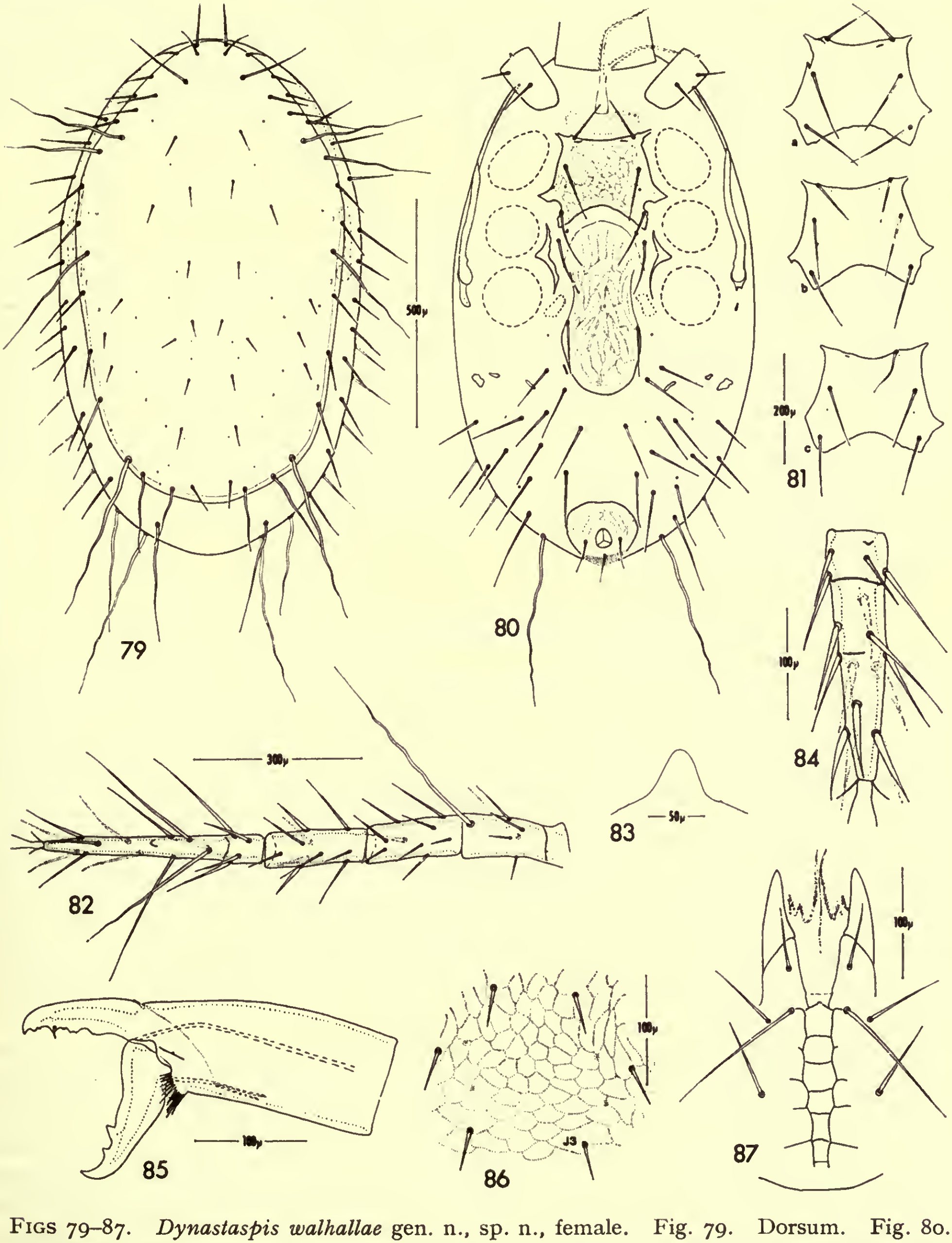
FEMALE: A single dorsal shield (1030 µm long and 580 µm wide) covers the dorsum incompletely, faintly ornamented with a scale-like pattern (fig. 86), with 32 pairs of simple setae (fig. 79). Eighteen pairs of podonotal setae, z3 absent, s7 on the integument and 14 pairs of opisthonotal setae (S4 and px2–3 absent). Medial setae mainly short (e.g. i4—45 µm), s4–6 long and 'wavy', Z4 being the longest dorsal setae (400 µm). Tectum (fig. 83) with nondenticulate margin and broad median projection.

Tritosternum normal with pilose laciniae. Sternal shield (140 µm long and 195 µm wide at St2), well ornamented with concave anterior margin and deeply concave posterior margin (fig. 80, 81a–c). Sternal setae long, St2 extending beyond posterior margin of shield. The shape of the sternal shield is variable, mainly in the lateral outlines (figs 81a–c, in 81c one St1 completely missing). Genital shield (distance between genital setae 155 µm) tongue-shaped, with very distinct ornamentation which is completely different from that found in species of *Hypoaspis* s. str. Metapodal shields small and irregular, several small platelets present at the same level. Anal shield nearly triangular in shape, postanal seta shorter than the paranal setae. The peritreme extends anteriorly slightly beyond the posterior margin of coxa I, it is free anteriorly and posteriorly.

Gnathosoma (fig. 87) with well-sclerotized corniculi and fimbriate internal malae, with six rows of deutosternal teeth (10–14 per row). Movable digit of the chelicera (fig. 85) bidentate, fixed digit with about eight denticles of different sizes and shapes.

The approximate lengths of the legs (excluding pretarsi) are: I—1010 µm; II—850 µm; III—870 µm; IV—1190 µm. Tarsus II (fig. 84) with pointed setae only, leg IV (fig. 82) with macrosetae on femur (400 µm) and four macrosetae (ad_2, al_3,

pl_2, pd_3) on the tarsus with *pd_2* proximally inserted. Otherwise leg chaetotaxy normal.


500µ
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a
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c
81
79
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87
85
86
100µ

Figs 79–87. *Dynastaspis walhallae* gen. n., sp. n., female. Fig. 79. Dorsum. Fig. 80. Venter. Fig. 81a–c. Variations in shape of sternal shield. Fig. 82. Leg IV. Fig. 83. Tectum. Fig. 84. Tarsus II. Fig. 85. Chelicera. Fig. 86. Ornamentation of dorsal shield. Fig. 87. Gnathosoma, ventral view.

MATERIAL: Holotype: ♀, ex larvae of *Dynastes tytius* Linn. (Scarabaeidae: Dynastinae), dead Black Locust Tree, Walhalla, South Carolina, August 1969, coll. M. Palmer. Paratypes: 8 ♀♀, same data as type.

NOTES: The occurrence of this species on larvae of *Dynastes tytius* is rather surprising as Sikora (1968) reported a different species of '*Coleolaelaps*' from the adult of *D. tytius*. It may be that the host association of *D. walhallae* is accidental, the true host being another woodboring beetle.

Angosomaspis gen. n.

FEMALE: Single dorsal shield with a large number (over 100) of minute (15–20 μm) setae, ventral integument with about 30 pairs of long, very attenuated whip-like setae. Macroseta of femur IV exceedingly long, extending beyond middle of tarsus IV, only one macroseta (*pd_2*) on tarsus IV. Long macroseta also on femora II and III. Tarsus II with two subterminal spine-like setae which are originally pointed, though usually the tip is broken off, leaving a sharp (not blunt) end. Fixed digit of chelicera with about a dozen sharp, needle-shaped denticles proximal to the pilus dentilis. Remaining characters similar to *Hypoaspis*.

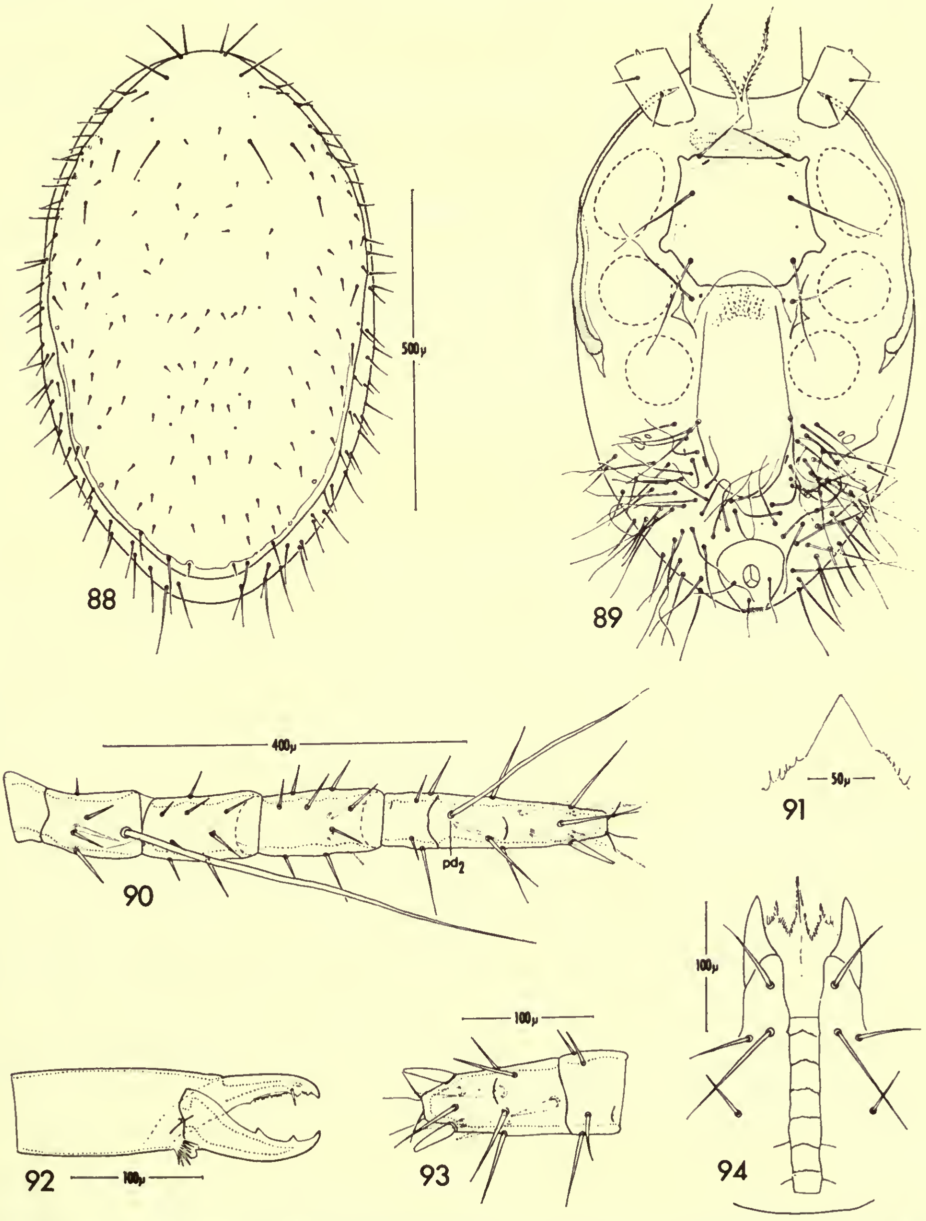
MALE: Unknown.

Angosomaspis multisetosus sp. n.

FEMALE: Dorsum covered by single dorsal shield (800 μm long and 480 μm wide) covering most of the dorsum. Over a 100 minute setae (15–20 μm) are distributed on the shield, obscuring any paired arrangement. Only four pairs of anterior setae and one pair of posterior marginal setae are of 'normal' *Hypoaspis*-type length and appearance (60–95 μm). The distribution and the relative lengths of the setae are shown in fig. 88. The laterodorsal chaetotaxy is obscured by a row of setae which are inserted on the soft integument between the narrow peritrematal shield and the dorsal shield, in mounted specimens this part of the integument invariably folds below the dorsal shield and only the examination of the mite in lateral position reveals that these setae are not inserted on the shield. The dorsal shield is finely granulated but shows no ornamentation. Tectum (fig. 91) triangulate with margins partly or totally denticulate.

Tritosternum normal with long pilose laciniae. Sternal shield (190 μm long and 170 μm wide at St2) with straight anterior and posterior margin, finely granulated surface without ornamentation. Sternal setae long (e.g. St2—150 μm) and whiplike, very attenuated and coming to a fine end, they are similar to the remaining (about 30 pairs) ventral setae. Genital shield large and elongate (distance between genital setae 145 μm), devoid of ornamentation. Anal shield with slightly curved anterior margin, paranal setae longer than postanal seta. The peritreme extends anteriorly slightly beyond the middle of coxa I, it is accompanied by a very narrow external and internal peritrematal shield which is free both anteriorly and posteriorly.

Gnathosoma (fig. 94) with well-sclerotized corniculi and fimbriate internal malae with six rows of minute deutosternal denticles. Movable digit of chelicera (fig. 92) bidentate, fixed digit with about a dozen fine pointed denticles proximal to the pilus dentilis.



FIGS 88–94. *Angosomaspis multisetosus* gen. n., sp. n., female. Fig. 88. Dorsum. Fig. 89. Venter. Fig. 90. Leg IV. Fig. 91. Tectum. Fig. 92. Chelicera. Fig. 93. Tarsus II. Fig. 94. Gnathosoma, ventral view.

The approximate lengths of the legs (excluding pretarsi) are: I—760 µm; II—650 µm; III—680 µm; IV—890 µm. Long macrosetae on femora II–IV, ad_1 of femur IV (490 µm) extending beyond the middle of the corresponding tarsus. Only one macroseta (pd_2) on tarsus IV (fig. 90). Tarsus II (fig. 93) with two subterminal pointed spine-like setae, usually the tip is broken off leaving a sharp jagged surface.

MATERIAL: Holotype: ♀, ex *Angosoma centaurus* (Scarabaeidae: Dynastinae), nr. Abidjan, Ivory Coast, 1969, coll. Dr M. Remillet. Paratypes: 20 ♀♀, same data as type.

Promacrolaelaps gen. n.

FEMALE: Large mites with a convex dorsal shield which covers the sides and the dorsum. Thirty-one pairs (17 podonotal and 14 opisthonotal) of long setae are inserted on the shield. Genital shield large, expanded posterior to the genital setae. Macrosetae present on femora I–IV, genua III–IV and single macroseta on tarsus IV. Tarsus II without spine-like or spur-like setae. Gnathosoma with seven rows of deutosternal denticles, fixed digit of chelicera with six medium-sized sharp teeth proximal to the pilus dentilis.

MALE: Unknown.

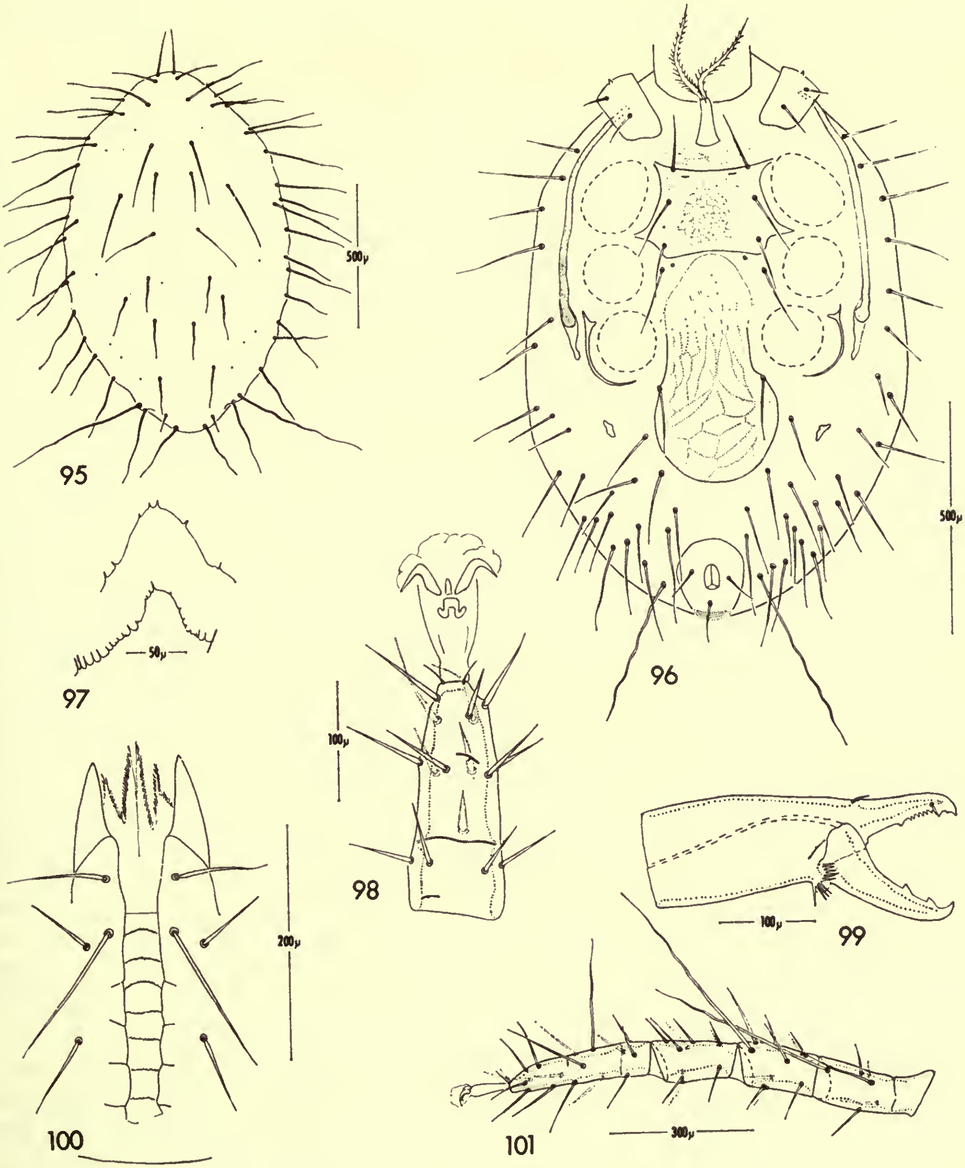
Promacrolaelaps hunteri sp. n.

FEMALE: The dorsum is completely covered by a large convex dorsal shield (1260 µm long and 820 µm wide) which covers the mite also laterally. Thirty-one pairs of simple long setae (17 podonotal and 14 opisthonotal) are inserted on the shield. Setae Z4 are the longest (510 µm) dorsal setae. The shape of the shield as well as the lateral displacement of many setae did not permit positional homologization of most setae, théir distribution and relative lengths being shown in fig. 95. Tectum (fig. 97) with denticulate margin.

Tritosternum normal, with pilose laciniae. Sternal shield (170 µm long and 210 µm wide at St2) wider than long, with long sternal setae extending considerably beyond the bases of consecutive setae. The shield is ornamented and granulate, its anterior and posterior margins are straight to slightly concave. Genital shield (fig. 96) large (distance between genital setae 220 µm), well ornamented and expanding posterior to the genital setae. Metapodal shields small and irregular. Anal shield with rounded anterior margin, postanal seta slightly longer than paranal setae. The anal shield is flanked by a pair of long (370 µm) setae. Approximately 17 pairs of setae are inserted on the integument posterior to coxae IV. The peritreme extends anteriorly beyond the middle of coxa I and is free both anteriorly and posteriorly.

Gnathosoma (fig. 100) with well-sclerotized corniculi and fimbriate internal malae, seven rows of deutosternal teeth (10–20 per row) are present. Movable digit of the chelicera (fig. 99) bidentate, fixed digit with six well-defined, medium-sized sharp teeth proximal to the pilus dentilis.

The approximate lengths of the legs (excluding pretarsi) are: I—980 μm; II—850 μm; III—830 μm; IV—930 μm. Macrosetae present in femora I and II (pd_1), III and IV (ad_1, 450 μm long on femur IV); on genua III and IV (ad_1, 450 μm long on genu IV) and a single macroseta (pd_2—250 μm) on tarsus IV (fig. 101).



Figs 95–101. *Promacrolaelaps hunteri* gen. n., sp. n., female. Fig. 95. Dorsal shield. Fig. 96. Venter. Fig. 97. Tectum. Fig. 98. Tarsus II. Fig. 99. Chelicera. Fig. 100. Gnathosoma, ventral view. Fig. 101. Leg IV.

Tarsus II (fig. 98) with simple pointed setae only, the ventral setae being slightly stouter.

This species is named in honour of my friend and colleague Dr P. E. Hunter (Department of Entomology, The University of Georgia).

MATERIAL: Holotype: ♀, ex *Promacrus bimucronatus* Pallas (Scarabaeidae: Euchirinae), Tivon, Israel, August 20, 1967, coll. M. Costa. Paratypes: 5 ♀♀, same data as type.

DISCUSSION

The vague early definition of genera and species can often be applied to several different taxa subsequently discovered. In the present study the early descriptions and figures of *Hypoaspis krameri* Can. apply equally well to *H. krameri* Can. sensu Evans & Till (1966), *H. neokrameri* sp. n.; *H. pentodoni* sp. n.; *H. phyllognathi* sp. n.; *H. integer* Berlese sensu Samšiňák (1960), etc. Vitzthum (1940–43) records '*H. krameri*' from the following hosts: *O. nasicornis*, *Cetonia aurata*, *Potosia floricola*, *Pentodon punctatus*, *Polyphylla fullo*—apparently placing under *H. krameri* several species with a higher degree of host specificity than assumed by him. The uncertainty of the determination of mites of the *Hypoaspis* and *Coleolaelaps* complexes by Berlese has been discussed by Costa & Hunter (op. cit.). In view of this early species confusion and the fact that their material was obtained from a new host, namely *Lucanus* sp., it seems rather uncertain that *H. krameri* Can. sensu Evans & Till is actually conspecific with the type species, it undoubtedly agrees with the description and definition of *Hypoaspis* s. str. However, in order to avoid additional confusion on the subject, the decision made by Evans & Till is accepted here until the type (? lost) or topotypic material from the type host can be examined. The definition of *Hypoaspis* s. str. as conceived here, as well as the definition of *Coleolaelaps* Berl. as conceived by Costa & Hunter (op. cit.) will necessitate the transfer of many species from the latter genus to *Hypoaspis* s. str., this being, however, outside the scope of the present study.

Being convinced that host-association is just as good a character for taxonomic discrimination as morphological characters, I have designated four new genera of which the first two (*Lucanaspis* and *Dynastaspis*) are closer related to *Hypoaspis* s. str. than the remaining two (*Angosomaspis* and *Promacrolaelaps*). As additional species are expected for these genera, the generic definitions are short and not very rigorous, allowing amendment for the inclusion of new species. The generic delimitations being to a large degree a matter of personal opinion, I prefer this treatment to the lumping of many different forms for 'phylogenetic' reasons.

The juvenile forms of *Hypoaspis* s. str. are described here for the first time (*H. rhinocerotis* and *H. athasiae*) and they agree to the general type of the free-living laelapids (vide *H. aculeifer* (Can.), Evans & Till, op. cit.). I should like to point out the 'long-haired' nature of the juveniles: the protonymph having longer setae than the deutonymph and this having longer setae than the adult.

The occurrence of macrosetae on the idiosoma as well as on the legs, mainly leg IV, seems to have arisen independently in various mesostigmatic mites associated with arthropods. The function of the macrosetae is at present unknown, it may be mainly thigmotactic and concerned with finding the right location on the host, or it may also serve to avoid overcrowding on the host, assuring each mite its own volume of space.

SUMMARY

The following species and genera of mites associated with phytophagous lamellicorn beetles are described and figured: *Hypoaspis neokrameri* sp. n. (♀); *Hypoaspis pentodoni* sp. n. (♀, ♂); *Hypoaspis phyllognathi* sp. n. (♀); *Hypoaspis integer* Berlese (♀); *Hypoaspis rhinocerotis* Ouds. (♀, ♂, dn, pn); *Hypoaspis athiasae* sp. n. (♀, ♂, dn, pn); *Hypoaspis dubius* sp. n. (♀); *Hypoaspis remilleti* sp. n. (♀); *Lucanaspis brachypedes* gen. n., sp. n. (♀); *Dynastaspis walhallae* gen. n., sp. n. (♀); *Angosomaspis multisetosus* gen. n., sp. n. (♀); *Promacrolaelaps hunteri* gen. n., sp. n. (♀).

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It is my pleasure to express greatful thanks to Dr P. E. Hunter (Department of Entomology, The University of Georgia, Athens) for his generous hospitality, his continuous interest and for his criticism of parts of the manuscript.

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THE POLYCHAETE FAUNA OF THE SOLOMON ISLANDS

P. E. GIBBS

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THE BRITISH MUSEUM (NATURAL HISTORY)
ZOOLOGY Vol. 21 No. 5
LONDON : 1971

THE POLYCHAETE FAUNA OF THE SOLOMON ISLANDS

BRITISH MUSEUM
28 SEP 1971
NATURAL HISTORY

BY
PETER EDWIN GIBBS
Marine Biological Association of the U.K., Plymouth

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THE POLYCHAETE FAUNA OF THE SOLOMON ISLANDS

By P. E. GIBBS

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SYNOPSIS

An account of the polychaete fauna of the Solomon Islands (western Pacific Ocean) is given, based on a large collection which was obtained during the Royal Society Expedition in 1965. A total of 220 species are recorded. Two new genera (Family Nereidae), 13 new species and 3 new subspecies are described. The zoogeographical affinities of the fauna are analysed and certain ecological aspects discussed.

INTRODUCTION

As pointed out by Knox (1958), the polychaetes of the Pacific Islands are poorly known and much work remains to be done before a relatively complete biogeographical analysis can be made. Apart from reports on small collections or individual families, comprehensive accounts of the polychaetes from any of the island groups in the tropical west Pacific regions are few. Augener (1927*a*) records 47 species from New Britain and Fauvel (1947) describes about 100 species from New Caledonia. The fauna of the Marshall Islands is comparatively well known with 131 species recorded as a result of the work of Hartman (1954) and, more recently, of Reish (1968).

The Solomon Islands are situated between the latitudes of 5°S and 12°S and between the longitudes of 155°E and 163°E. From the zoogeographical viewpoint these islands are of great interest since they lie between the faunistic centre of the

Indo-west-Pacific region, the Malay Archipelago, and the more distant islands of the Central Pacific. Thus, one of the primary aims of the Expedition organized by the Royal Society of London in 1965 was to determine the biogeographical relationships of these islands with the adjacent regions. As a member of the Marine Party of this Expedition the author spent five months, from July to December, investigating the polychaete fauna and this paper is an account of the ecological and faunistic observations that were made during this period.

I am indebted to the Royal Society, Professor E. J. H. Corner, F.R.S., (Expedition Leader) and Professor J. E. Morton (Leader of the Marine Party) for the opportunity to participate in the Expedition to the Solomon Islands in 1965. For their help in the field I have to thank the members of the Marine Party, particularly Dr. D. R. Stoddart, Captain S. B. Brown and crew of the A. K. *Maroro*, and our native assistants, especially Ini Munamaori. I am also grateful to Wilson Ifunaoa for providing a valuable collection of the 'palolo' rising from Fanalei, Malaita.

For their kind assistance and helpful advice in the identification of various specimens and families, I have to thank Dr. Olga Hartman (two new genera of Nereidae), Dr. Minoru Imajima (Syllidae), Dr. Charlotte Mangum (Maldanidae) and Professor G. P. Wells (*Abarenicola*). Other groups were identified by Dr. P. Bergquist (Porifera), Miss A. Clark (Echinodermata) and Dr. S. J. Edmonds (Sipunculoidea). I am also indebted to Dr. J. D. George for the loan of specimens from the collections of the British Museum (Natural History).

GENERAL ACCOUNT

The Marine Party of the Expedition was based and carried out investigations on Guadalcanal, in the Florida Islands (Nggela Group), Russell Islands and New Georgia Group (for a detailed account of the Expedition, see Corner, 1969). In these areas, collections of polychaetes were obtained from the following localities (see figs 1 and 2): western end of Guadalcanal – Komimbo Bay, Cape Esperance and Naro Bay; north coast of Guadalcanal – Mamara Point, Honiara and Lunga Point; eastern end of Guadalcanal (Marau Sound) - Graham Point, Fintry Point, Maraunibina Island, Pigeon Island, and Lauvie Island; Florida Islands – Kokomtambu Island, Tetel (or Gaskell) Island, Nggela (or Florida) Island and Haroro; Russell Islands (Banika Island) – Yandina, Sifola and Lingatu; New Georgia Group (Marovo Lagoon) – Matiu Island, Pirikale Island, Paleki Island and Batuona (or Wickham) Island. Additional collections were made at Gizo Island (New Manra) and on Malaita – Auki Harbour, Kalota Island, Alite Harbour and at the southern end of Maramasike Passage.

The polychaete fauna of the moderate to very exposed coral reef platforms consists chiefly of coral-boring and crevice-dwelling species. To obtain such species it is necessary to break open the coral rock with hammer and chisel and then carefully extract the worms from their burrows or from crevices using forceps. Those species living amongst the algal cover or chaetopterid tubes are best obtained by dissecting and then washing these materials. Investigations of these habitats were

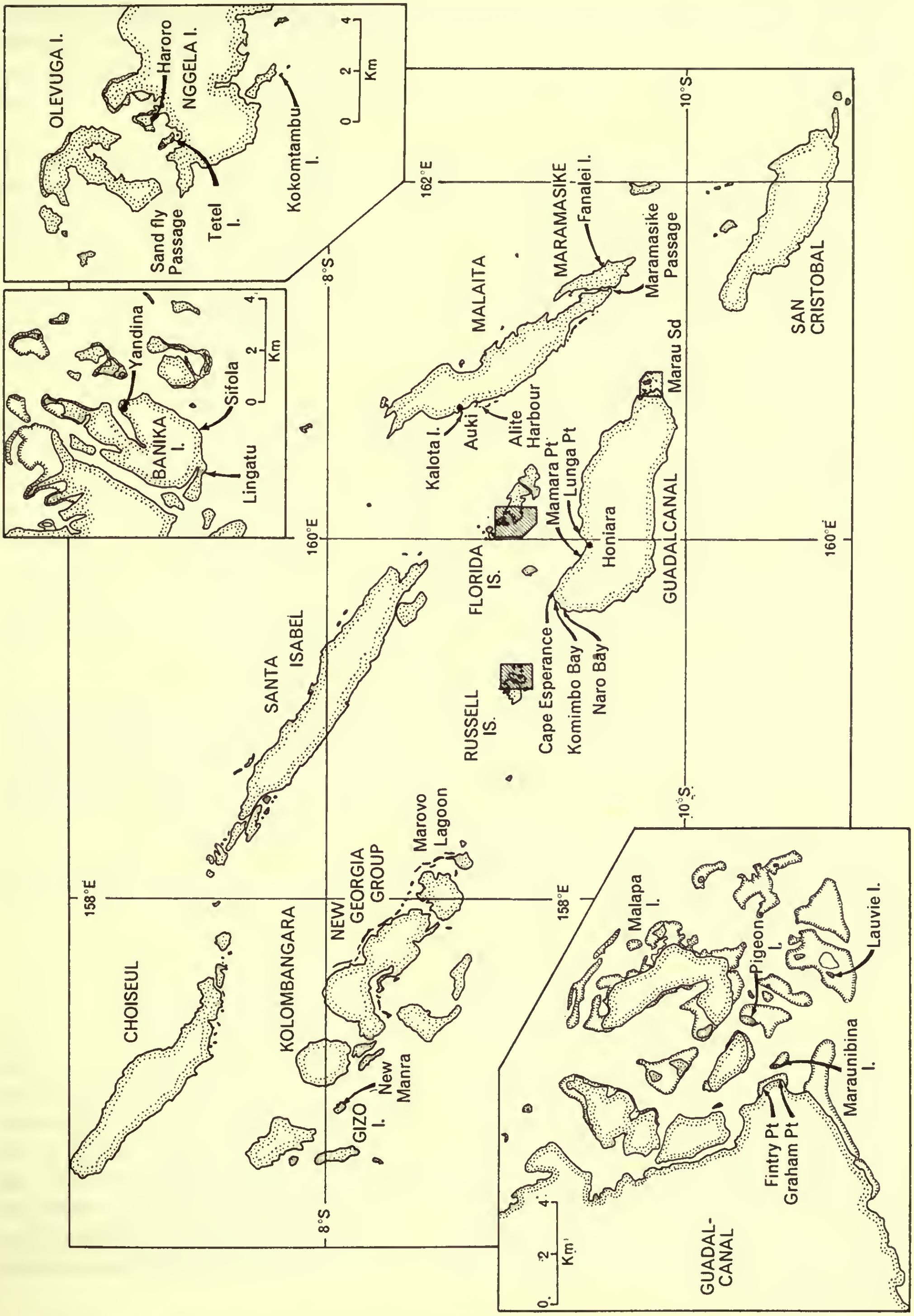
OLEVUGA I.
Haroro
NGGELA I.
Sand fly Passage
Tetel I.
Kokomtambu I.
0 2 4
Km
Yandina
Sifola
BANIKA I.
Lingatu
0 2 4
Km
8°S
162°E
10°S
MALAITA
MARAMASIKE
Fanalei I.
Maramasike Passage
Marau Sd
SAN CRISTOBAL
Kalota I.
Auki
Alite Harbour
Mamara Pt
Lunga Pt
Honiara
GUADALCANAL
160°E
1
2
FLORIDA IS.
RUSSELL IS.
Cape Esperance
Komimbo Bay
Naro Bay
SANTA ISABEL
Marovo Lagoon
NEW GEORGIA GROUP
158°E
10°S
CHOISEUL
KOLOMBANGARA
New Manra
GIZO I.
8°S
Malapa I.
Pigeon I.
Lauvie I.
Maraunibina I.
Fintry Pt
Graham Pt
GUADAL-CANAL
0 2 4
Km

FIG. 1. Map of the Solomon Islands showing collection localities mentioned in the text. Insets – Marau Sound (left) and parts of the Russell Islands and Florida Islands (right).

made at (collection dates in brackets) Mamara Pt. (24.viii), Sifola (2.ix), Lingatu (19.x), Matiu and Paleki Is. (3–7.vii and 27–31.viii), Batuona I. (3.ix) and at New Manra (4–5.ix). Further collections were made at Kokomtambu I. (2.vii) and at Maramasike Pg. (26.xi). Beachrock fauna was investigated at Lauvie I. (18.ix and 4.x).

On the more sheltered shorelines a wide range of sedimentary deposits was studied. The larger species of the infauna were obtained by digging and the smaller species by sieving samples of the deposit through 0·5, 1·0 or 2·0 mm mesh, the mesh size depending on the grade of the sediment. Investigations of the infauna inhabiting a variety of deposits, ranging from thick mud to shell gravel and coral debris, were carried out at Tetel I., Haroro and Nggela I. (5–10.vii and 24–29.vii), Komimbo Bay, Cape Esperance and Naro Bay (18–20.vii and 16–21.viii), Graham Pt., Fintry Pt. and Maraunibina I. (17.ix–10.x). Small collections were also made at Yandina (18.x) and Honiara (28.xi).

In addition to the above studies, further species were obtained from a brackish water lagoon at Lunga Point near the mouth of the Lunga River (9.ix–11.ix) and from encrusting organisms, particularly sponges, on wharf piles at Yandina (19–20.x and 5.xi). At a number of the localities mentioned above and including Auki Hr. and Kalota I. (20–22.xi) commensal polychaetes were discovered. It was not possible for the author to be present at a rising of the 'palolo' but a small collection of the spawning that took place at Fanalei on 2–3.xi.66 was kindly forwarded by Wilson Ifunaoa. Dredging operations were confined to the New Georgia Group where a survey of the benthos of Marovo Lagoon was carried out during the period 22.x–14.ix in conjunction with the studies of Dr. D. R. Stoddart.

The nomenclature used in this paper is that of Hartman (1959, 1965) although later revisions by various authors have been followed. The classification used by Day (1967) has been adopted. The usage of the place-names in the Solomon Islands is that given on the Directorate of Overseas Survey Map (1 : 1,000,000). Other names are taken from the Admiralty Charts or are local names, the spelling of which must be regarded as provisional.

The collections, including the type specimens, have been deposited in the British Museum (Natural History).

COMPOSITION OF THE POLYCHAETE FAUNA AND ITS ZOOGEOGRAPHICAL AFFINITIES

The collection of polychaetes from the Solomon Islands comprises over 2000 specimens and is composed of 220 species.* Of this total, 88 (40%) of the species are represented by only one or two specimens. Thus the actual number of species in the fauna must be much higher, perhaps as high as 400, since probably many of the smaller and less conspicuous species, including many of the syllids as well as the paraonids and spirorbids, were overlooked in the field. The species composition of the fauna by families is given in Table 1. The errantiate families Aphroditidae (24 species), Eunicidae (22) and Syllidae (20) are well represented and in total account for about one-half of the errant species. Sedentary species are fewer (97 out of the total of 220) with the family Spionidae (15) containing the most species. In the collection, two new genera, namely *Cryptonereis* n.gen. and *Solomononereis* n.gen. (Family Nereidae), 13 new species and three new subspecies are present. The new species and subspecies are the following:

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* See Appendix

TABLE I

The species composition of the Solomon Islands fauna by families.

Family	No. of species	Family	No. of species
Aphroditidae	24	Chaetopteridae	6
Palmyridae	3	Cirratulidae	5
Amphinomidae	10	Cossuridae	1
Phyllodocidae	13	Flabelligeridae	1
Pilargidae	2	Scalibregmidae	2
Hesionidae	4	Opheliidae	5
Syllidae	20	Sternaspidae	1
Sphaerodoridae	1	Capitellidae	7
Nereidae	16	Arenicolidae	1
Nephtyidae	3	Maldanidae	8
Lacydoniidae	1	Oweniidae	4
Glyceridae	4	Sabellariidae	2
Eunicidae	22	Pectinariidae	1
Orbiniidae	2	Ampharetidae	2
Spionidae	15	Terebellidae	10
Magelonidae	2	Sabellidae	11
Trochochaetidae	2	Serpulidae	9
	TOTAL	220	

Family Aphroditidae	*Hololepidella ophiuricola* n.sp.
	Lepidasthenia guadalcanalis n.sp.
Family Hesionidae	*Gyptis maraunibinae* n.sp.
Family Nereidae	*Cryptonereis malaitae* n.gen., n.sp.
	Solomononereis marauensis n.gen., n.sp.
Family Nephtyidae	*Nephtys* (*Aglaophamus*) *munamaorii* n.sp.
Family Eunicidae	*Eunice marovoi* n.sp.
Family Spionidae	*Dispio maroroi* n.sp.
	Polydorella novaegeorgiae n.sp.
	Prionospio tetelensis n.sp.
	Scolelepis squamata mendanai n. subsp.
Family Trochochaetidae	*Poecilochaetus serpens honiarae* n. subsp.
Family Flabelligeridae	*Diplocirrus glaucus orientalis* n. subsp.
Family Opheliidae	*Ophelia koloana* n.sp.
Family Oweniidae	*Myriochele heruensis* n.sp.
Family Terebellidae	*Pista dibranchis* n.sp.

The species collected in the Solomon Islands are listed in Table 2. From the material three species – all maldanids – can be identified to the subfamily level only, 17 are referable to their genus and a further six can be given near identifications to comparable species. Excluding these species and also the new species and subspecies a total of 178 species is available for analysis.

TABLE 2

List of species taken in the Solomon Islands.

APHRODITIDAE

Gastrolepidia clavigera Schmarda
Harmothoë nigricans Horst
Harmothoë sp.
Hololepidella nigropunctata (Horst)
H. ophiuricola n.sp.
Iphione muricata (Savigny)
Lepidasthenia elegans (Grube)
L. maculata Potts
L. guadalcanalis n.sp.
L. microlepis Potts
L. stylolepis Willey
Lepidonotus (*Thormora*) *jukesi* (Baird)
Paradyte crinoidicola (Potts)
Paralepidonotus ampulliferus (Grube)
P. indicus (Potts)
Polyodontes maxillosus (Ranzani)
P. melanonotus (Grube)
Psammolyce zeylanica Willey
Sigalion bandaënsis Horst
Sthenelais heterochela Horst
S. zeylanica Willey
Sthenelanella ehlersi (Horst)
Sthenolepis japonica (McIntosh)
Thalenessa digitata McIntosh

PALMYRIDAE

Bhawania goodei Webster
B. pottsiana Horst
Paleanotus debilis (Grube)

AMPHINOMIDAE

Amphinome nigrobranchiata Horst
Chloeia conspicua Horst
Euphrosine foliosa Aud. & M.-Ed.
E. myrtosa Savigny
Eurythoë complanata (Pallas)
? *Eurythoe* sp.
Notopygos gregoryi Holly
N. sibogae Horst
Pareurythoë pitipanaensis De Silva
Pseudeurythoë paucibranchiata Fauvel

PHYLLODOCIDAE

Eteone japanensis McIntosh
Eulalia albopicta Marenzeller
E. viridis (Linnaeus)
E. (*Pterocirrus*) *magalhaensis* Kinberg
Notophyllum splendens (Schmarda)
Phyllodoce fristedti Bergström
P. malmgreni Gravier
P. pruvoti Fauvel
P. quadraticeps Grube
P. (*Anaitides*) *madeirensis* Langerhans
P. (*Anaitides*) *parva* Hartmann-Schröder
P. (*Genetyllis*) *castanea* (Marenzeller)
P. (*Genetyllis*) *gracilis* Kinberg

PILARGIDAE

Sigambra hanaokai (Kitamori)
Synelmis albini (Langerhans)

HESIONIDAE

Gyptis capensis (Day)
G. maraunibinae n.sp.
Hesione splendida Savigny
Leocrates chinensis Kinberg

SYLLIDAE

Autolytus sp.
Brania clavata (Claparède)
Exogone gemmifera Pagenstecher
E. uniformis Hartman
E. verugera (Claparède)
Haplosyllis spongicola (Grube)
Langerhansia cornuta (Rathke)
L.? rosea (Langerhans)
Sphaerosyllis hirsuta Ehlers
Syllis longissima Gravier
Syllis sp. cf. *gracilis* Grube
Trypanosyllis coeliaca Claparède
T. (*Trypanedenta*) sp.
Typosyllis alternata (Moore)
T. armillaris (Müller)
T. brachycola (Ehlers)

T. exilis (Gravier)
T. lucida (Chamberlin)
T. prolifera (Krohn)
Typosyllis sp.

SPHAERODORIDAE

Sphaerodoridium claparedii (Greeff)

NEREIDAE

Ceratonereis costae (Grube)
C. erythraeënsis Fauvel
C. mirabilis Kinberg
Cryptonereis malaitae n.g.n.sp.
Namalycastis indica (Southern)
Nereis (*Neanthes*) *caudata* (Delle Chiaje)
N. (*Neanthes*) *unifasciata* Willey
N. (*Neanthes*) cf. *kerguelensis* McIntosh
Perinereis cultrifera (Grube)
P. nigropunctata (Horst)
P. nuntia (Savigny)
Platynereis insolita Gravier
Pseudonereis anomala Gravier
P. masalacensis (Grube)
P. variegata (Grube)
Solomononereis marauensis n.g.n.sp.

NEPHTYIDAE

Nephtys (*Aglaophamus*) *munamaorii* n.sp.
N. (*Micronephthys*) *sphaerocirrata* Wesenberg-Lund
N. (*Nephtys*) sp. cf. *palatii* Gravier

LACYDONIIDAE

Paralacydonia weberi Horst

GLYCERIDAE

Glycera gigantea Quatrefages
G. lancadivae Schmarda
G. longipinnis Grube
G. rouxi Aud. & M.-Ed.

EUNICIDAE

Arabella iricolor (Montagu)
A. mutans (Chamberlin)
Dorvillea sp.
Drilonereis major Crossland
Eunice afra Peters
E. antennata (Savigny)
E. aphroditois (Pallas)
E. coccinea Grube
E. grubei Gravier
E. marovoi n.sp.
E. norvegica (Linnaeus)
E. tentaculata Quatrefages
E. tubifex Crossland
E. (*Palola*) *siciliensis* Grube
Lumbrineris latreilli Aud. & M.-Ed.
L. papillifera (Fauvel)
L. sphaerocephala (Schmarda)
Lysidice collaris Grube
Marphysa macintoshi Crossland
Nematonereis unicornis (Grube)
Oenone fulgida (Savigny)
Onuphis (*Nothria*) *holobranchiata* Marenzeller

ORBINIIDAE

Haploscoloplos bifurcatus Hartman
Naineris laevigata (Grube)

SPIONIDAE

Dispio maroroi n.sp.
Laonice cirrata (Sars)
Malacoceros indicus (Fauvel)
Nerinides sp. cf. *gilchristi* Day
Polydorella novaegeorgiae n.sp.
Prionospio cirrifera Wirén
P. ehlersi Fauvel
P. malmgreni Claparède
P. pinnata Ehlers
P. steenstrupi malayensis Caullery
P. tetelensis n.sp.
Pseudopolydora corallicola Woodwick
Pseudopolydora sp.
Scolelepis squamata mendanai n.subsp.
Spio filicornis (Müller)

MAGELONIDAE

Magelona japonica Okuda
Magelona sp.

TROCHOCHAETIDAE

Poecilochaetus serpens honiarae n.subsp.
P. tropicus Okuda

CHAETOPTERIDAE

Chaetopterus variopedatus (Renier)
Mesochaetopterus sagittarius (Claparède)
Phyllochaetopterus elioti Crossland
P. herdmani (Hornell)
P. socialis Claparède
Spiochaetopterus costarum costarum (Claparède)

CIRRATULIDAE

Cirriformia filigera (Delle Chiaje)
C. punctata (Grube)

Dodecaceria fistulicola Ehlers
D. laddi Hartman
Tharyx sp.

COSSURIDAE
Cossura coasta Kitamori

FLABELLIGERIDAE
Diplocirrus glaucus orientalis n.subsp.

SCALIBREGMIDAE
Hyboscolex longiseta Schmarda
Scalibregma inflatum Rathke

OPHELIIDAE
Armandia lanceolata Willey
A. leptocirrus (Grube)
A. longicaudata (Caullery)
Ophelia koloana n.sp.
Polyophthalmus pictus (Dujardin)

STERNASPIDAE
Sternaspis scutata (Renier)

CAPITELLIDAE
Capitellethus dispar (Ehlers)
Capitobranchus sp.
Dasybranchus caducus (Grube)
Mastobranchus dollfusi Fauvel
M. trinchesii Eisig
Mediomastus sp. cf. *capensis* Day
Notomastus sp.

ARENICOLIDAE
Abarenicola claparedii claparedii (Levinsen)

MALDANIDAE
Clymenella (= *Macroclymene*) sp. 1
Clymenella (= *Macroclymene*) sp. 2
Clymenella (= *Euclymene*) sp.
Euclymeninae sp. A.
Euclymeninae sp. B.
Euclymeninae sp. C.
? *Nicomache* sp.
Praxillella sp.

OWENIIDAE
Myriochele eurystoma Caullery
M. heruensis n.sp.
Myriochele sp.
Owenia fusiformis Delle Chiaje

SABELLARIIDAE
Lygdamis ehlersi (Caullery)
L. indicus Kinberg

PECTINARIIDAE
Pectinaria (*Pectinaria*) *antipoda* Schmarda

AMPHARETIDAE
Isolda pulchella Müller
? *Sosane wireni* Caullery

TEREBELLIDAE
Amaeana trilobata (Sars)
Euthelepus kinsemboënsis Augener
Eupolymnia nebulosa (Montagu)
Loimia medusa (Savigny)
Lysilla ubianensis Caullery
Pista dibranchis n.sp.
P. typha (Grube)
Reteterebella queenslandia Hartman
Terebella ehrenbergi Grube
Terebellides stroemi Sars

SABELLIDAE
Branchiomma cingulata (Grube)
Hypsicomus phaeotaenia (Schmarda)
Megalomma intermedium (Beddard)
M. linaresi (Rioja)
M. quadrioculatum (Willey)
M. trioculatum Reish
M. vesiculosum (Montagu)
Potamilla ehlersi Gravier
Sabella fusca Grube
S. melanostigma Schmarda
Sabellastarte sanctijosephi (Gravier)

SERPULIDAE
Filograna implexa Berkeley
Hydroides minax (Grube)
H. uncinata (Philippi)
Mercierella enigmatica Fauvel
Serpula hartmanae Reish
S. vermicularis Linnaeus
Spirobranchus coutierei (Gravier)
S. giganteus (Pallas)
Vermiliopsis glandigerus Gravier

At this stage a zoogeographical analysis of the Solomon Islands fauna can be regarded only as provisional since many areas within the Indo-Pacific still remain to be investigated and further records, as well as taxonomic revisions, will modify the known distribution patterns of many species. The data for this analysis are given in Table 3. The faunistic regions outlined in this table are necessarily broad: in the Pacific region, only those island groups for which the polychaete faunas are fairly well known are considered. As far as possible, synonymies have been taken into account. In compiling the distributional data for each species the following references have been consulted:

(i)	Eastern Atlantic	Augener, 1918; Fauvel, 1923, 1927; Kirkegaard, 1959.
(ii)	Mediterranean Sea	Fauvel, 1923, 1927.
(iii)	South Africa	Day, 1967.
(iv)	East Africa (Red Sea to 32°S)	Crossland, 1903, 1904, 1924; Day, 1962, 1967; Gravier 1900–1908.
(v)	Indian waters (Persian Gulf to Andaman Is.)	De Silva, 1961, 1965, 1965*a*; Fauvel, 1953; Tampi & Rangarajan, 1964; Wesenberg-Lund, 1949.
(vi)	South-west Australia	Augener, 1913, 1914; Fauvel, 1922; Kott, 1949.
(vii)	Malay Archipelago (Malaya to New Guinea and including Philippine and Palau Is.)	Caullery, 1944; Ehlers, 1920; Fauvel, 1935, 1939; Horst, 1910–1924; Mesnil & Fauvel, 1939; Okuda 1937*a*; Pillai, 1965.
(viii)	East Australia (south to Port Jackson)	Augener, 1927; Monro, 1931; Rullier, 1965; Russell, 1962; Straughan, 1967.
(ix)	New Caledonia	Fauvel, 1947.
(x)	Central Pacific (Society and adjacent Islands)	Fauvel, 1947; Monro, 1928, 1939, 1939*a*.
(xi)	New Zealand	Augener, 1924, 1926; Ehlers, 1904; Knox, 1951, 1951*a*, 1960.
(xii)	Marshall Islands	Hartman, 1954; Reish, 1968.
(xiii)	Hawaii	Hartman, 1966; Straughan, 1969.
(xiv)	Japan	Imajima & Hartman, 1964; Imajima, 1966–1967.

Of the total of 178 species recorded from the Solomon Islands, 21 or 11·8% are considered to be cosmopolitan in their distribution and can be eliminated from the analysis in order to obtain a clearer pattern of the faunal relationships.

As expected, the Solomon Islands fauna has a large overlap with the faunas of the Malay Archipelago (61·1%) and of Indian waters (64·3%), and over one-half (55·4%) of the species are known to extend to the east coast of Africa. Thus the Indo-west-Pacific component forms a high proportion of the Solomon Islands fauna. In the Pacific region, it is interesting that the number of species in common between the

TABLE 3

	East Atlantic	Mediterranean	South Africa	East Africa	Indian waters	South-west Australia	Malay Archipelago	East Australia	New Caledonia	Central Pacific	New Zealand	Marshall Islands	Hawaii	Japan
Total number of species in common (Sol. Is. total = 178)	76	53	58	105	122	38	113	53	53	31	32	57	36	65
Number of cosmopolitan species in common (Sol. Is. = 21)	21	18	19	18	21	7	17	12	10	6	13	11	11	16
Number of non-cosmopolitan species in common (157 species)	55	35	39	87	101	31	96	41	43	25	19	46	25	49
Percentage	35·0	22·3	24·8	55·4	64·3	19·7	61·1	26·1	27·4	15·9	12·1	29·3	15·9	31·2

Analysis of the zoogeographical affinities of the Solomon Islands fauna. The records for each of the Solomon Islands species occurring in the regions outlined above have been taken from the references given in the text: a summary table of these data has been deposited in the Polychaeta Section of the British Museum (Natural History).

Solomon Islands and other Island groups lying within the tropics decreases with increasing distance: the faunas of both New Caledonia and the Marshall Islands show similar affinities (27·4% and 29·3% respectively) as do the faunas of the islands of the Central Pacific (15·9%) and Hawaii (15·9%). A relatively high proportion of the Solomon Islands species extend to Japan (31·2%) but fewer than expected have been recorded from the east coast of Australia (26·1%) although this percentage should probably be much higher.

It is difficult to compare these results with those of previous analyses because of the lack of earlier records from the tropical west Pacific. For example, Knox (1958) had records of only 81 species from this region (Micronesia – Melanesia) for his analysis of the distribution of polychaetes in the Indo-Pacific region and of this total 27% were Indo-Pacific and 31% were cosmopolitan. However the larger number of records from the present survey indicates that the Indo-Pacific element is proportionally much greater. Interestingly, previous estimates of the Indo-Pacific element in the faunas of New Zealand and Japan, of 12% and 30% respectively (Knox, 1963; Imajima & Hartman, 1964), closely correspond to the overlaps calculated above between these two regions and the Solomon Islands, the fauna of the latter being essentially Indo-Pacific.

The records from the Solomon Islands have extended the known distribution of thirteen species from the Indian Ocean to the West Pacific region. These species are *Lepidasthenia stylolepis*, *Psammolyce zeylanica*, *Pareurythoë pitipanaensis*, *Phyllodoce fristedti*, *Syllis longissima*, *Platynereis insolita*, *Lumbrineris papillifera*, *Marphysa macintoshi*, *Prionospio ehlersi*, *Phyllochaetopterus elioti*, *P. herdmani*, *Spiochaetopterus costarum costarum* and *Megalomma quadrioculatum*. A further six species were known only from Atlantic or Mediterranean waters, namely *Trypanosyllis coeliaca*, *Sphaerodoridium claparedii*, *Mastobranchus dollfusi*, *M. trinchesii*, *Abarenicola claparedii*, and *Megalomma linaresi*.

As noted above the fauna of the Solomon Islands appears to be essentially Indo-Pacific and apart from the new species and subspecies that were discovered, relatively few of the species remain unrecorded from the Indian Ocean. This Pacific element in the fauna is represented by such species as *Notopygos gregoryi*, *Eteone japanensis*, *Phyllodoce pruvoti*, *P.* (*Anaitides*) *parva*, *Sigambra hanaokai*, *Exogone uniformis*, *Typosyllis brachycola*, *T. lucida*, *Pseudonereis masalacensis*, *Haploscoloplos bifurcatus*, *Pseudopolydora corallicola*, *Poecilochaetus tropicus*, *Reteterebella queenslandia*, *Megalomma trioculatum* and *Serpula hartmanae*. However most of these species have few records and probably have yet to be discovered elsewhere.

ECOLOGICAL OBSERVATIONS

Littoral survey

Although it is not practicable to list fully the species taken at each of the littoral stations, the short accounts that follow are presented as an outline of the ecological assemblages of species encountered in several of the more important habitats, in particular, those found on the reef platforms along the more exposed shorelines and those composing the infauna of certain sedimentary deposits present in sheltered coastal areas. The habitats of each species are given in the Systematic Account. The tidal range in the Solomon Islands is small, being about 1·0 m in amplitude at springs, and investigations were generally concentrated betwen mid-tide level and low water mark.

The importance of the boring activities of polychaetes was recognized by Gardiner (1903) who regarded them as the "prime and most effective agents" in the destruction of coralline rocks. This view has been supported by Johnson (in Hartman, 1954). Boring is effected chiefly by the abrasive action of either hard pharyngeal structures, such as possessed by the nereids and eunicids, or by modified setae, as in certain spionids and cirratulids (Hartman, 1954). However as pointed out by Utinomi (1953) it is often difficult to distinguish between those species which actually bore into the coral from those which utilize and perhaps enlarge the vacated burrows made by boring species. For example, from its habit the sabellid *Hypsicomus phaeotaenia* appears to be a boring species but it does not possess hard chitinized structures that could be used for penetration. Whether chemical action is employed by such a species has yet to be investigated. Few polychaetes contribute to reef formation by virtue of their construction of massed tubes and in the Solomon Islands only *Spirobranchus giganteus* appears to be sufficiently common to be considered a minor contributor to reef growth.

On the reef platforms at moderately or very exposed localities, such as at Matiu, Batuona and Gizo, sedentary species are surprisingly few although quite extensive colonies of *Phyllochaetopterus socialis* are often present in places. On the other hand, errant species are fairly numerous, particularly the nereids and eunicids, which form the bulk of the destructive species, including *Perinereis nigropunctata*, *Pseudonereis anomala*, *P. masalacensis*, *P. variegata* and perhaps *Platynereis insolita*, together with *Eunice afra*, *E. antennata*, *E. coccinea*, *E. tentaculata*, *E.* (*Palola*) *siciliensis* and *Lysidice collaris*. Other species which may contribute to reef breakdown are *Nematonereis unicornis*, *Arabella mutans*, *Dodecaceria fistulicola* and *Hypsicomus phaeotaenia*. Many of these boring species are also common amongst the surface cover on the reef, that is, amongst algal growth (e.g. *Amphiroa*), or *Phyllochaetopterus* tubes, where they accompany the crevice-dwelling species which utilize such shelter when the reef is exposed at low-tide. The crevice-dwelling species are many and are represented by *Lepidonotus* (*Thormora*) *jukesi*, *Paleanotus debilis*, *Eurythoë complanata*, *Euphrosine myrtosa*, *Eulalia* (*Pterocirrus*) *magalhaensis*, *Phyllodoce fristedti*, *P. pruvoti*, *P. quadraticeps*, *Synelmis albini*, *Exogone gemmifera*, *Syllis longissima*, *Trypanosyllis coeliaca*, *Typosyllis alternata*, *T. armillaris*, *T. brachycola*, *T. prolifera*, *Cirriformia punctata* and *Terebella ehrenbergi*. Encrusting forms include *Vermiliopsis glandigerus* and *Hydroides minax*. An inconspicuous species of this habitat is *Bhawania goodei* which, although found free-living, most frequently occurs as a commensal in the burrows of the sipunculids *Aspidosiphon elegans*, *Cloeosiphon aspergillum* and *Phascolosoma albolineatum*.

In sheltered localities the reef platforms are generally covered by a layer of sediment which is often composed of a wide variety of deposit grades ranging from sticky mud to coarse coral debris. At Tetel Island it was possible to investigate an assortment of deposits in a small area and the following lists of species discovered in four different grades of sediment give an indication of the diversity of the polychaete infauna.

(i) In muddy silt-sand at about mid-tide level: *Iphione muricata, Lepidasthenia elegans, L. maculata, Sthenelais zeylanica, Eurythoë complanata, Eteone japanensis, Phyllodoce malmgreni, Langerhansia cornuta, Onuphis* (*Nothria*) *holobranchiata, Malacoceros indicus, Poecilochaetus serpens honiarae* n. subsp., *P. tropicus, Mesochaetopterus sagittarius, Phyllochaetopterus elioti, P. herdmani, Pista dibranchis* n.sp., *P. typha* and *Megalomma vesiculosum. L. elegans* and *L. maculata* were discovered cohabiting the tubes of *M. sagittarius* and *P. herdmani* respectively. Living under coral boulders lying on this fine deposit, further species were uncovered, namely, *Pseudeurythoë paucibranchiata, Typosyllis alternata, T. brachycola, Perinereis cultrifera, P. nuntia, Glycera lancadivae, Nematonereis unicornis, Arabella iricolor, Spiochaetopterus costarum costarum, Hyboscolex longiseta, Dasybranchus caducus, Lysilla ubianensis* and *Loimia medusa.*

(ii) In coarse coral debris, chiefly *Acropora* fragments, towards low water mark: *Eurythoë complanata, Notopygos sibogae, Pseudeurythoë paucibranchiata, Leocrates chinensis, Ceratonereis mirabilis, Eunice aphroditois, E.* (*Palola*) *siciliensis, Cirriformia filigera, Armandia lanceolata, Loima medusa, Reteterebella queenslandia, Branchiomma cingulata, Hypsicomus phaeotaenia, Megalomma intermedium, M. linaresi, Sabellastarte sanctijosephi, Spirobranchus giganteus* and *S. coutierei.*

(iii) In shell gravel at low water mark: *Lepidonotus* (*Thormora*) *jukesi, Amphinome nigrobranchiata, Pareurythoë pitipanaensis, Leocrates chinensis, Glycera lancadivae, Eunice* (*Palola*) *siciliensis, Onuphis* (*Nothria*) *holobranchiata, Mesochaetopterus sagittarius* and *Dasybranchus caducus.*

(iv) In coarse coral sand just below low water mark: *Eurythoë complanata, Magelona japonica, Poecilochaetus serpens honiarae* n. subsp., *P. tropicus, Mesochaetopterus sagittarius, Spiochaetopterus costarum costarum, Capitobranchus* sp. *Dasybranchus caducus, Mastobranchus trinchesii, ?Nicomache* sp., *Pista dibranchis* n. sp. and *Megalomma vesiculosum.*

At Graham Point in Marau Sound (east Guadalcanal) extensive deposits of silty sand mixed with shell gravel are colonised by marine angiosperms (*Thalassia* and others) and support a rich and varied fauna. Of the polychaetes encountered here the most interesting are three *Lepidasthenia* species which were found living as commensals. *L. microlepis* and *L. stylolepis* were both discovered in the burrows of the sipunculid *Siphonosoma vastus* while the third species, *L. guadalcanalis* n.sp., was an inhabitant of the burrows of a large enteropneust (probably *Balanoglossus carnosus*). The polychaete infauna comprises the following species: *Polyodontes maxillosus, Psammolyce zeylanica, Sthenelais zeylanica, Amphinome nigrobranchiata, Eurythoë complanata, Pseudeurythoë paucibranchiata, Glycera gigantea, G. lancadivae, Eunice* (*Palola*) *siciliensis, Naineris laevigata, Dispio maroroi* n.sp., *Scolelepis squamata mendanai* n.subsp., *Poecilochaetus tropicus, Mesochaetopterus sagittarius, Dasybranchus caducus, Mastobranchus trinchesii, Clymenella* (*Macroclymene*) sp. and

Pista dibranchis n.sp. Many of these species are also found below coral boulders together with further species including *Iphione muricata, Sigalion bandaënsis, Notopygos sibogae, Pareurythoë pitipanaensis, Phyllodoce madeirensis, Notophyllum splendens, Synelmis albini, Gyptis maraunibinae* n.sp., *Hesione splendida, Typosyllis brachycola, Perinereis nigropunctata, Eunice antennata, E. grubei, Lysidice collaris, Lumbrineris latreilli, Eupolymnia nebulosa,* and *Euthelepus kinsemboënsis.* In this habitat, *Hololepidella nigropunctata* and *H. ophiuricola* n.sp. are also found but living as commensals on ophiuroids.

Dredge Survey of Marovo Lagoon

Along the north-east coast of New Georgia Island and around the north and east coasts of Vangunu Island in the New Georgia Group, elevated barrier reefs form the

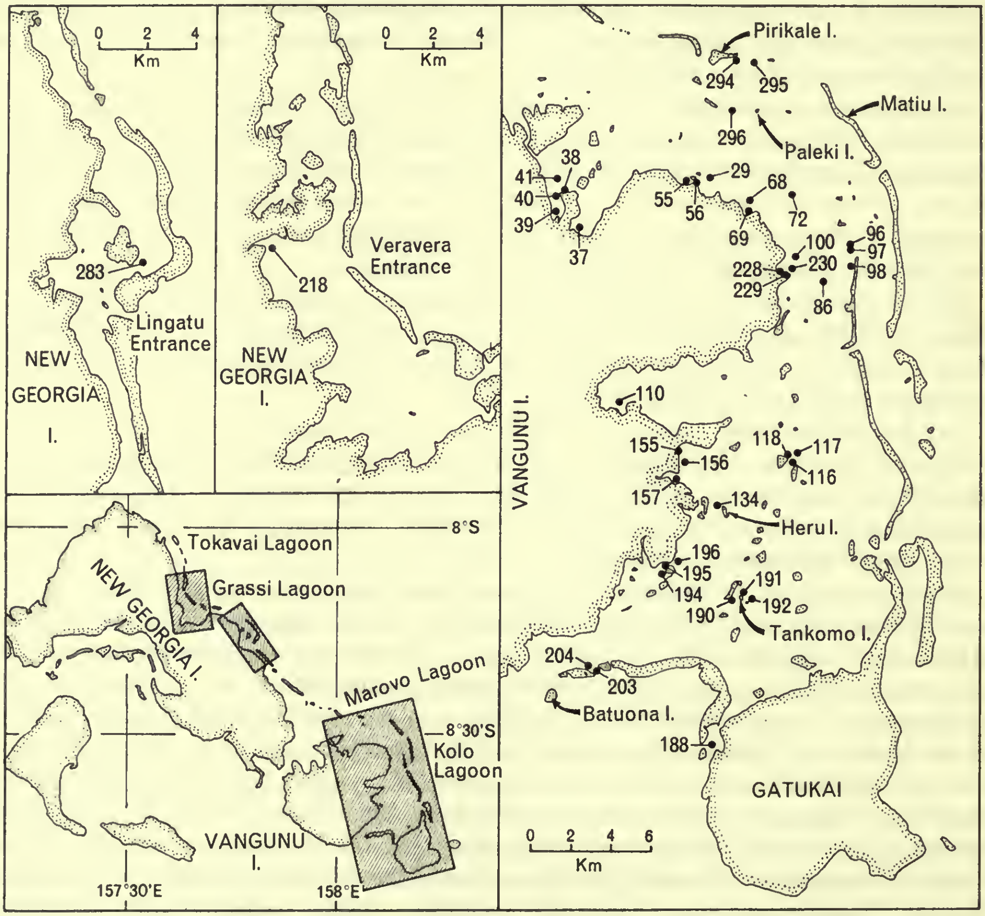
0 2 4
Km
283
Lingatu Entrance
NEW GEORGIA I.
0 2 4
Km
218
Veravera Entrance
NEW GEORGIA I.
8°S
Tokavai Lagoon
Grassi Lagoon
NEW GEORGIA I.
Marovo Lagoon
8°30'S
Kolo Lagoon
VANGUNU I.
157°30'E
158°E
Pirikale I.
294
295
Matiu I.
296
Paleki I.
38
29
41
40
39
37
55
56
68
72
69
96
97
98
100
230
228
229
86
110
VANGUNU I.
118
117
155
156
116
157
134
Heru I.
196
195
194
191
192
190
Tankomo I.
204
203
Batuona I.
188
GATUKAI
0 2 4 6
Km

FIG. 2. Collection localities and positions of the dredge stations in Marovo Lagoon, New Georgia Group.

seaward edge of a more or less continuous lagoon. This lagoon is about 10 km across at its widest point, and its depth is less than 50 m over most of its area. Marovo Lagoon forms the central part of this lagoon, the northern extension being Tokavai and Grassi Lagoons and the southern part Kolo Lagoon. However, for convenience, these lagoons will be collectively referred to as Marovo Lagoon. The geomorphology of the region has been described by Stoddart (1969).

A benthic survey of Marovo Lagoon was carried out in October and November 1965. Qualitative samples of the bottom deposits were taken at 40 stations in depths from 2 to 35 m, using a small naturalist's dredge. Two stations (ML 218 and 283) were worked in the northern part of the lagoon, the rest being situated in the central and eastern parts (fig. 2). The fauna was extracted from the samples (between 10 and 20 l of sediment) by sieving through a mesh of 1·0 or 2·0 mm diameter. The bottom deposits vary from thick terrigenous mud, which occurs close to the mainland, to coarse coralline sands which are found along the inner margins of the outer reefs. The station data are given in Table 4.

TABLE 4

Dredge survey of Marovo Lagoon: station data. See fig. 2 for station positions.

Station (ML)	Date (1965)	Depth (m)	Deposit	Station (ML)	Date (1965)	Depth (m)	Deposit
29	22.x.	22	Silty mud	155	30.x.	9	Mud
37	23.x.	22	Mud	156	30.x.	18	Mud
38	23.x.	9	Silty mud	157	30.x.	13	Mud
39	25.x.	11	Mud	188	1.xi	18	Mud
40	25.x.	18	Mud	190	1.xi	5	Sand
41	25.x.	20	Mud	191	1.xi	2	Silty sand
55	26.x.	11	Silty mud	192	1.xi	18	Coarse sand
56	26.x.	9	Silty mud	194	2.xi	11	Mud
68	27.x.	2	Mud	195	2.xi	11	Mud
69	27.x.	13	Silty mud	196	2.xi	2	Silty sand
72	27.x.	35	Silty sand	203	3.xi	4	Coarse sand
96	28.x.	9	Sand	204	3.xi	18	Coarse sand
97	28.x.	9	Sand	218	8.xi	18	Mud
98	28.x.	11	Sand	228	10.xi	5	Mud
100	28.x.	33	Mud	229	10.xi	5	Sand
110	28.x.	26	Mud	230	10.xi	24	Silty sand
116	29.x.	15	Silty sand	283	13.xi	2	Coarse sand
117	29.x.	5	Sand	294	14.xi	4	Coarse sand
118	29.x.	2	Sand	295	14.xi	4	Coarse sand
134	29.x.	16	Foram sand	296	14.xi	2	Coarse sand

A total of 65 species were taken during the survey of which 43 were not recorded from the littoral zone. This category includes all the species records of the families Nephtyidae (3 species), Lacydoniidae (1), Cossuridae (1), Flabelligeridae (1), Sternaspidae (1), Oweniidae (4), Pectinariidae (1), and Ampharetidae (2). In addition the survey provided specimens of four new species, namely, *Nephtys* (*Aglaophamus*) *munamaorii* n.sp., *Polydorella novaegeorgiae* n.sp., *Ophelia koloana* n.sp. and *Myriochele heruensis* n.sp. and also one new subspecies, *Diplocirrus glaucus orientalis*. Of the species taken, ten have not been recorded from the West Pacific, outside of the Malay Archipelago (*Sthenelais heterochela*, *S. zeylanica*, *Sthenelanella ehlersi*, *Chloeia conspicua*, *Prionospio steenstrupi malayensis*, *Armandia longicaudata*, *Myriochele eurystoma*, *Isolda pulchella*, *Sosane wireni* and *Lysilla ubianensis*) and the distributions of two species (*Lumbrineris papillifera* and *Prionospio ehlersi*) are extended from the coast of East Africa. A further two species, namely, *Pseudopolydora corallicola* and *Megalomma trioculatum*, have been described only recently from the Marshall Islands. *Haploscoloplos bifurcatus* was previously known only from south and south-east Australia.

The survey provides some indications of the distribution of the commoner species with respect to the bottom deposits. Arbitrarily defining a "common" species as one that was present at three or more stations, the following appear to be mainly restricted to the finer grades of sediments (mud and fine sands)—*Sthenelais heterochela*, *Sthenolepis japonica*, *Pseudeurythoë paucibranchiata*, *Sigambra hanaokai*, *Nephtys* (*Aglaophamus*) *munamaorii* n.sp., *Paralacydonia weberi*, *Haploscoloplos bifurcatus*, *Prionospio ehlersi*, *P. pinnata*, *P. tetelensis* n.sp., *Diplocirrus glaucus orientalis* n. subsp., *Armandia lanceolata*, *Mastobranchus dollfusi*, *Isolda pulchella*, *Loimia medusa*, and *Terebellides stroemi*. The coarser deposits (medium to coarse sands) appear to support sparse polychaete populations and only *Owenia fusiformis* was taken in any numbers. Species that tolerate a wide range of deposit grades include *Glycera gigantea*, *G. lancadivae*, *Eunice marovoi* n.sp., *Prionospio steenstrupi malayensis*, *Armandia leptocirrus*, *Pectinaria* (*Pectinaria*) *antipoda*, and *Pista dibranchis* n.sp. Apart from these common species, several appear to be locally abundant, to judge from the large numbers present at single stations. For example, *Onuphis* (*Nothria*) *holobranchiata* was abundant in the sample of the thick mud at ML 69. Small species such as *Polydorella novaegeorgiae* n.sp. and *Myriochele heruensis* n.sp. were probably much more abundant than the sample figures at ML 39 and ML 134 suggest, no doubt many specimens being lost during sieving.

Commensal polychaetes

During the routine sampling of a number of habitats, a total of twelve species, mainly polynoids, were discovered living in association, apparently as commensals, with other animals, principally echinoderms and sipunculids. Observations on these associations have been presented in an earlier paper (Gibbs, 1969) but for the sake of completeness the commensal species and their hosts are summarized in Table 5.

Although Macnae & Kalk (1962) have described similar associations from the coast of Moçambique, probably many have yet to be discovered throughout the Indo-Pacific region. Undoubtedly the echinoderms which act as hosts for *G. clavigera*, *Hololepidella* spp. and *P. crinoidicola*, are more numerous than the present records indicate.

TABLE 5

Summary of the commensal polychaetes and their hosts in the Solomon Islands. Abbreviations: Po – Polychaeta; Si – Sipunculoidea; Ga – Gastropoda; Oph – Ophiuroidea; Ho – Holothuroidea; Cr – Crinoidea.

Commensal	Host(s)
Bhawania goodei	*Aspidosiphon elegans* (Si) *Cloeosiphon aspergillum* (Si) *Phascolosoma albolineatum* (Si)
B. pottsiana	*Eurythoë complanata* (Po)
Eunice marovoi n.sp.	*Cerithium vertagus* (Ga)
Gastrolepidia clavigera	*Bohadschia argus* (Ho) *B. graffei* (Ho) *Holothuria* (*Halodeima*) *atra* (Ho) *Stichopus chloronotus* (Ho) *Thelenota ananas* (Ho)
Hololepidella nigropunctata	*Ophiarthrum elegans* (Oph) *Ophiocoma brevipes* (Oph) *O. insularia* forma *dentata* (Oph)
H. ophiuricola n.sp.	*Macrophiothrix koehleri* (Oph) *Ophiarthrum pictum* (Oph)
Lepidasthenia elegans	*Mesochaetopterus sagittarius* (Po)
L. guadalcanalis n.sp.	Enteropneust (*Balanoglossus carnosus?*)
L. maculata	*Phyllochaetopterus herdmani* (Po)
L. microlepis	*Paraspidosiphon cumingi* (Si) *Siphonosoma vastus* (Si)
L. stylolepis	*Siphonosoma vastus* (Si)
Paradyte crinoidicola	*Himerometra robustipinna* (Cr)

Recently, Dr R. U. Gooding kindly sent the author three specimens of *H. nigropunctata* taken from two *Acanthaster planci* L. collected at Kira-Kira, San Cristobal I. (3.xii.69) and a further specimen taken from *Diadema savignyi* Michelin collected on the Reef Is., Santa Cruz Is. (8.xii.69).

Brackish water and terrestrial species

Investigations of brackish water were mainly confined to a lagoon at Lunga Point, near the mouth of the Lunga River on the north coast of Guadalcanal. At the time of examination (9.ix–11.ix) the salinity of the lagoon was 5·6‰, whilst that of the outside seawater was 34·5‰. Three polychaete species were discovered in this habitat, namely *Namalycastis indica*, *Pseudopolydora* sp. and *Mercierella enigmatica*. Specimens of *N. indica* were found burrowing amongst the fibres composing the outer husk of the *Nipa* palm nut, many of which were lying waterlogged along the water's edge. The two other species were present in large numbers within the interstices of a sponge that was growing around submerged tree roots. The specimens of *Pseudopolydora* have proved to represent a new species (W. J. Light, personal communication) and those of the cosmopolitan *M. enigmatica* are also of interest in that they show the characters of *Neopomatus* and thus support Straughan's (1966) evidence for the belief that *Neopomatus* is the warm water form of *Mercierella*. Further details of these two species are given below in the Systematic Account.

Wesenberg-Lund (1958) has shown that the majority of freshwater polychaetes are nereids and thus it is not surprising that those species which have been discovered in damp terrestrial habitats also belong to this family, in particular to the subfamily Namanereinae. In view of the fact that terrestrial forms are well documented from the East Indies (see Feuerborn, 1932; Lieber, 1931; Pflugfelder, 1933) their discovery in the nearby Solomon Islands is to be expected.

Two small specimens belonging to the Namanereinae were separately collected by members of the Expedition Land Party (Dr. J. Greenslade and Mr. J. Peake) on Mt. Austen, Guadalcanal and on Kolombangara in the New Georgia Group. Both were taken from moist leaf litter at an altitude of 350 m. Unfortunately the identity of these important specimens is uncertain due to damage and although they closely resemble *Namanereis amboinensis* (Pflugfelder) they may belong to *Cryptonereis malaitae* n.gen., n.sp., described below, which may also be a damp terrestrial form. Until further specimens from relatively high altitudes are available the status of these specimens must remain undetermined. Any information concerning their mode of reproduction would be of great interest.

Spawning of *Eunice* (*Palola*) *siciliensis*

The spawning of the circumtropical species *Eunice* (*Palola*) *siciliensis* is well documented for the Pacific region and accounts of this phenomenon, which usually takes place in October or November, have been given by many authors, notably Burrows (1945, 1955), Caspers (1961), Gravier (1924), Miller & Pen (1959), Stair (1847) and Woodworth (1907). Although the Samoan name 'palolo' is the most commonly used for this species, it has a variety of names, being known as 'paroro' on Rotuma, 'balolo' in the Fiji Islands, and 'hundu' in the New Hebrides. In the Solomon Islands it has several names; in the Florida Islands, West Guadalcanal and on Malaita it is called either 'ogu' or 'odu' and at the eastern end of San Cristobal it is known as 'parenga'. Lever (1945) records that it is called 'orku' on Ulawa Island. Collection of the 'rising' appears to be a dying custom in the Solomon Islands since many of the natives interviewed stated that they had not done so for many years and certainly only the older men could relate the details of the event. From their description of the rising, it would appear that the spawning of this species appears to be essentially similar to that described for other areas.

The author could not be present at a rising but fortunately a valuable collection of the spawning worms was obtained by Wilson Ifunaoa (a schoolboy attached to the Expedition) from Fanalei Island (also called Falelei or Halelei Island), off the south-east coast of Maramasike Island, Malaita. This collection was made at the time of the rising on 2–3.xi.66 and four species are represented – *Phyllodoce* (*Anaitides*) *madeirensis*, *Perinereis cultrifera*, *Eunice coccinea* and *Lysidice collaris*, in addition to *Eunice* (*Palola*) *siciliensis*. The details of this material, together with the spawning times provided by the collector, are given in Table 6. There can be little doubt that all five species were spawning at the same time because all of the specimens either contain apparently mature gametes or are in the 'spent' condition. In a similar collection from the New Hebrides, Gravier (1924) records that *Lumbrineris sphaerocephala* and *Perinereis masalacensis* were present.

TABLE 6

Details of the material in the sample of the 'palolo' or 'ogu' rising at Fanalei, Malaita, collected on 2–3.xi.66 by Wilson Ifunaoa.

Species	Material	Time of spawning (hours)	Condition	Local name
Phyllodoce (*Anaitides*) *madeirensis*	3 specimens	1830–1900	Spent	Adio
Perinereis cultrifera	2 heteronereids (♀)	2000–2200	Ripe oocytes 200 μ in diameter	Falisu-ogu
Eunice coccinea	2 posterior fragments	0000–0600	Ripe oocytes 360 μ in diameter	Raka-raka
Eunice (*Palola*) *siciliensis*	4 posterior fragments	2000–2200	Ripe oocytes 200 μ in diameter	Falisu-ogu
Lysidice collaris	1 specimen	?	Spent	?

Also included in the collection of the 'palolo' or 'ogu' is a large specimen of *Notopygos gregoryi*, a species hitherto recorded only from Midway Island. It is thought that this specimen was feeding on the spawning worms as they emerged from the coral.

SYSTEMATIC ACCOUNT

The great majority of the records from the littoral zone were made between mid-tide level (MTL) and low water mark (LWM). Sublittoral or shallow-water samples were taken to a maximum depth of 35 m in Marovo Lagoon. For each species the number of specimens taken at each of the localities or stations (see figs 1 and 2) is given: where more than 20 specimens were found the species is indicated as numerous (num.)

Family **APHRODITIDAE**

Subfamily **POLYNOINAE**

Gastrolepidia clavigera Schmarda, 1861

Gastrolepidia clavigera Schmarda, 1861 : 159, pl. 36, fig. 316; Fauvel, 1953 : 51, fig. 22. d-f; Day, 1967 : 51, fig. 1.5. a-f.

HABITAT. A commensal of holothurians (see Gibbs, 1969 for notes).

RECORDS. On *Stichopus chloronotus* Brandt – Graham Pt. – 8; Maraunibina Is. – 12; Kalota Is. – 2; on *Holothuria* (*Halodeima*) *atra* Jaeger – Graham Pt. – 11; Kalota Is. – 5; Auki Hr. – num.; on *Bohadschia argus* Jaeger – Maraunibina Is. – 4; Kalota Is. – 15; on *Bohadschia graffei* Semper – Maraunibina Is. – 2; Yandina – 1; on *Thelenota ananas* (Jaeger) – Maraunibina Is. – 1.

DISTRIBUTION. Tropical Indo-west-Pacific.

Harmothoë nigricans Horst, 1915

Harmothoë nigricans Horst, 1915 : 14; 1917 : 90, pl. 20, figs 3–4.

HABITAT. Under coral boulders and in beachrock.

RECORDS. Tetel Is. – 1; Komimbo Bay – 4; Lauvie Is. – 1.

DISTRIBUTION. East Indies.

Harmothoë sp.

HABITAT. Crevice in reef platform.

RECORD. Maramasike Pg. – 1.

NOTES. The specimen has the typical harmothoid prostomium with pronounced lateral peaks and ventrally inserted lateral tentacles. The elytra number fifteen pairs and each carries large conspicuous tubercles. The latter are pear-shaped with wide bases, the largest of them being situated along the posterior margins of the elytra. Notosetae are numerous and coarsely serrated and neurosetae bidentate with a fine secondary tooth almost as long as the main one.

The specimen resembles *H. impar* (Johnston), known from Japan (Imajima and Hartman, 1964) but differs in that the elytral margins are strongly ciliated.

Hololepidella nigropunctata (Horst, 1915)

Polynoë nigro-punctata Horst, 1915 : 20; 1917 : 104, pl. 21, figs 15–17.
Hololepidella nigropunctata: Day, 1957 : 65, fig. 1. a-f; Devaney, 1967 : 287, figs 1–5; Pettibone, 1969a : 50, fig. 2. a-g.
Polyeunoa nigropunctata: Day, 1967 : 54, fig. 1.5. r-u.
Hololepidella minuta: Gibbs, 1969 : 449, fig. 131.

HABITAT. A commensal of ophiuroids living under coral boulders and in crevices on the reef platform (see Gibbs, 1969).

RECORDS. Graham Pt. – on *Ophiocoma brevipes* Peters – 8; on *Ophiocoma insularia* forma *dentata* Lütken – 1; on *Ophiarthrum elegans* Peters – 7.

NOTES. In the preliminary report on the commensal species (Gibbs, 1969) these specimens were referred to *Hololepidella minuta* (Potts, 1910) because they correspond, particularly in terms of their setae, with the type specimen of *Polynoë minuta* in the British Museum (Natural History). The latter specimen is incomplete however, having only 24 segments, and thus cannot be referred to the genus *Hololepidella* Willey with certainty because the generically characteristic, segmental arrangement of the elytra (Devaney, 1967; Pettibone, 1969*a*) cannot be checked. Unfortunately the type specimens of *Polynoë minuta* var. *oculata* Potts (1915) must be considered lost since they are not present in the British Museum nor in the Zoological Museum of the University of Cambridge (C. B. Goodhart, pers. comm.). Thus it seems advisable to refer the Solomon Islands specimens to *H. nigropunctata* (Horst) and to regard *P. minuta* as indeterminable. Possibly further specimens from crinoids at the type localities of *P. minuta* (South Male) and *P. minuta oculata* (Torres Straits) may clarify the problem.

DISTRIBUTION. Tropical Indo-west-Pacific to Hawaii.

Hololepidella ophiuricola n. sp.

(Fig. 3. A–H)

Hololepidella commensalis: Gibbs, 1969 : 451, fig. 132.

DESCRIPTION. The largest specimen (holotype) measures 15 mm in length, is 2·5 mm wide and has 53 segments bearing 25 pairs of elytra. Smaller specimens have 41 to 50 segments bearing 19 to 24 pairs of elytra.

The prostomium has marked antero-lateral peaks and two pairs of eyes (fig. 3. A). The median antenna and tentacular cirri are long and the lateral antennae are short and ventral in origin. The palps are stout and between 1·5 to 2·0 times the length of the prostomium. Both dorsal and ventral cirri are relatively long, the former being about equal to the width of the body, the latter about equal to the length of the neuropodial lobe.

The elytra are oval in shape and completely cover the body. They have smooth margins and are transparent except for small, irregular patches of black pigment contained in polygonal-shaped cells (fig. 3. B, C). As is characteristic of the genus, the elytra are carried on segments 2, 4, 5, 7, 9, . . . 21, 23, 26, 29, 31, 34, 36 and on alternate segments to the posterior end. The number of elytra depends on the segment number and in four of the five specimens there are 24 or 25 pairs on 49 to 53 segments.

The notopodial lobe is rather small (fig. 3. D) and carries 16 to 20 notosetae, each of which is minutely serrated along one edge (fig. 3. E). The neuropodium is bilobed with a triangular pre-setal lip and a rounded post-setal lip. There are 3 or 4 supra-acicular and 6 to 8 sub-acicular neurosetae. Superior neurosetae have about 15 rows of spinules and a smooth, curved tip (fig. 3. F): inferior neurosetae are shorter and more slender with minute serrations (fig. 3. G, H).

All specimens have a darkly pigmented dorsal surface the pattern of which may vary according to the species of the host ophiuroid (see Gibbs, 1969). The cirri and antennae are dark, as are the palps which also show a white longitudinal line on their dorsal surface. Apart from a dark circular spot at the base of each parapodium, the ventral surface is unpigmented.

H. ophiuricola may be distinguished from the type species *H. commensalis* Willey and from *H. nigropunctata* by its notosetae, the ornamentation of which differs in all three species. Also *H. ophiuricola* differs from the former species in having a greater number of notosetae (16 to 20 compared to 8) and from *H. nigropunctata* in having unidentate, not bidentate neurosetae. It should be noted that in a recent review of the genus *Hololepidella* Pettibone (1969*a*) considers the records of *H. commensalis* given by Augener (1922) and Fauvel (1932) from the Indian Ocean are doubtful in view of the fact that both sets of specimens differ from the type description in having bidentate neurosetae.

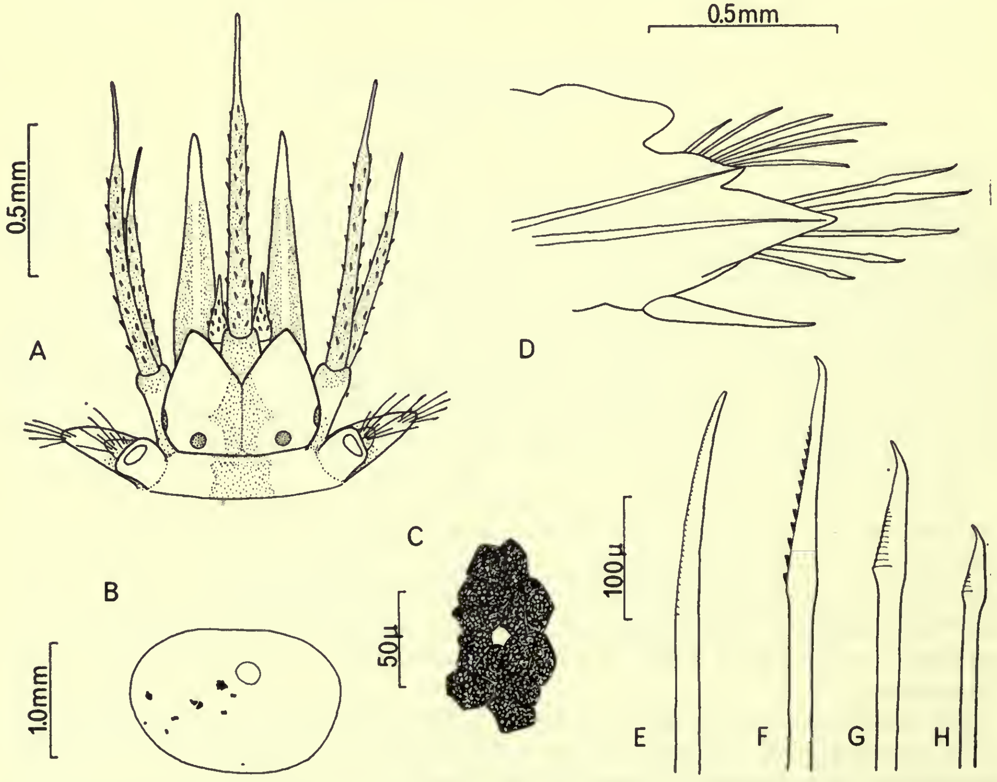

FIG. 3. *Hololepidella ophiuricola* n.sp. (A) Dorsal view of anterior region showing pigmentation. (B) Elytron from middle body. (C) Patch of pigment cells on elytron. (D) Elytrigerous parapodium from middle body. (E) Notoseta. (F–H) Superior and inferior neurosetae.

HABITAT. A commensal of ophiuroids living under coral boulders and in crevices on the reef platform.

RECORDS. Graham Pt. – on *Macrophiothrix koehleri* Clark – 4 (including holotype); Kalota Is. – on *Ophiarthrum pictum* Müller and Troschel – 1.

British Museum (Natural History) Registration No. Holotype 1970·20
Paratypes 1970·21–24

Iphione muricata (Savigny, 1818)

Iphione muricata: Fauvel, 1953 : 32, fig. 13. a-e; Day, 1967 : 43, fig. 1.3. a-f.

HABITAT. Under coral boulders in muddy silt and sand.

RECORDS. Tetel Is. – 3; Komimbo Bay – 3; Maraunibina Is. – 2; Graham Pt. – 24.

DISTRIBUTION. Tropical Indo-west-Pacific.

Lepidasthenia elegans (Grube, 1840)

Lepidasthenia elegans: Potts, 1910 : 342, pl. 19, fig. 16, pl. 20, fig. 32; Fauvel, 1923 : 88, fig. 33. a-g; Day, 1967 : 90, fig. 1.16. i-m.

HABITAT. In silt and cohabiting a tube of *Mesochaetopterus sagittarius* at LWM.

RECORDS. Tetel Is. – 2.

DISTRIBUTION. Mediterranean; Indo-west-Pacific.

Lepidasthenia guadalcanalis n. sp.

(Fig. 4. A–F)

Lepidasthenia mossambica: Gibbs, 1969 : 453, fig. 134.

DESCRIPTION. The holotype is the largest of the six specimens and measures 85 mm for about 125 segments. Preserved in alcohol the colour is pale brown with darker bars across the anterior segments. The fourth pair of elytra is coloured reddish-brown (fig. 4. A) but the other elytra are colourless.

The prostomium is roughly hexagonal in shape and has two pairs of eyes situated on the antero-lateral and posterior margins (fig. 4. B). The median and lateral antennae are terminal in origin and are about one half the length of the stout palps. The tentacular cirri are slightly longer than the antennae. The posterior margin of the prostomium is hidden by a conspicuous occipital flap which is heavily papillated. Similar papillae are to be found along the anterior and posterior edges of the anterior segments on their dorsal side and a few are present on the dorsal and ventral surfaces of the neuropodial lobes.

The elytra, which are arranged segmentally in the typical polynoid sequence, are thin, circular in shape and do not cover the mid-dorsal region of the body. They have smooth margins and lack papillae. Only the fourth pair, on segment 7, is pigmented and the others are almost transparent.

The dorsal cirri are about equal in length to the neuropodial lobes. The notopodial lobes are small and supported by an aciculum but the neuropodial lobes are well-developed with rounded, subequal, pre-setal and post-setal lips and short ventral cirri (fig. 4. C).

Notosetae appear to be entirely lacking. In the anterior segments the neurosetae are slender with a small subterminal tooth (fig. 4. D, E) and number about 30 per neuropodium. However in the middle body segments, the neurosetae are much stouter, fewer in number (14 or 15 per neuropodium) and lack subterminal teeth (fig. 4. F). The number of rows of spinules possessed by these setae is similar

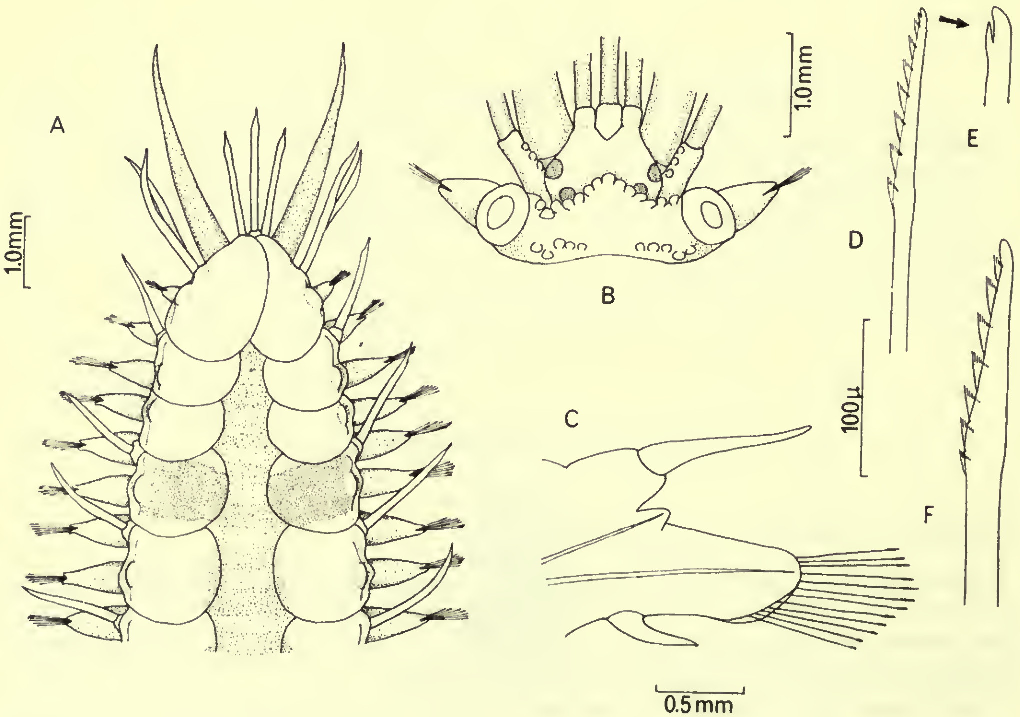

FIG. 4. *Lepidasthenia guadalcanalis* n.sp. (A) Dorsal view of anterior region showing pigmentation of fourth pair of elytra. (B) Head region. (C) Parapodium from middle body. (D–E) Superior neuroseta from anterior segment. (F) Superior neuroseta from middle body segment.

throughout the body, the superior ones having about 7, the inferior ones 4 or 5. Neither slender superior neurosetae in the anterior segments nor giant neurosetae in the posterior region could be found.

In possessing a distinctly papillated occipital flap, *L. guadalcanalis* resembles three other species, namely, *L. michaelseni* Augener, *L. terrareginae* Monro and *L. mossambica* Day. It differs from the former two species in lacking slender superior neurosetae and in having unidentate neurosetae in the middle segments. *L. guadalcanalis* is close to *L. mossambica*, to which these specimens were provisionally assigned (Gibbs, 1969), but a comparison of the type specimen of *L. mossambica* (in the British Museum, Natural History) has revealed important differences in the structure of the setae. In the middle segments of *L. guadalcanalis* the neurosetae are much stouter, fewer in number and have fewer rows of spinules (7 compared to 10 or 12) than in *L. mossambica* and the presence of small subterminal teeth on the neurosetae of the anterior segments of *L. guadalcanalis* also separates the two species. Furthermore the distinctive coloration of the fourth pair of elytra appears to be a characteristic feature of *L. guadalcanalis*.

HABITAT. A commensal of a large enteropneust (*Balanoglossus carnosus?*) living in silty sand (*Thalassia* flat).

RECORDS. Graham Pt. – 4; Fintry Pt. – 2 (including holotype).

British Museum (Natural History) Registration No. Holotype 1970·25
Paratypes 1970·26–28

Lepidasthenia maculata Potts, 1910

Lepidasthenia maculata Potts, 1910 : 344, pl. 20, fig. 33, pl. 21, fig. 51; Fauvel, 1953 : 58, fig. 27. h-k; Day, 1967 : 92, fig. 1.16. s-v.

HABITAT. In coarse sand, silt and within a tube of *Phyllochaetopterus herdmani*.

RECORDS. Haroro – 1; Tetel Is. – 2.

DISTRIBUTION. North Atlantic; Indian Ocean; Indo-China.

Lepidasthenia microlepis Potts, 1910

Lepidasthenia microlepis Potts, 1910 : 343, pl. 19, fig. 17, pl. 21, fig. 52; Fauvel, 1953 : 57, fig. 26. e-f; Day, 1967 : 90, 1.16. e-h.

HABITAT. A commensal of sipunculids. Hosts include *Siphonosoma vastus* (Selenka & Bülow) living in silty sand (*Thalassia* flat) and *Paraspidosiphon cumingi* (Baird) boring in a *Porites* boulder.

RECORDS. Graham Pt. – 4.

DISTRIBUTION. Tropical Indo-west-Pacific.

Lepidasthenia stylolepis Willey, 1907

Lepidasthenia stylolepis Willey, in Lloyd, 1907 : 260, figs 1–4; Gibbs, 1969 : 453, fig. 134.

HABITAT. A commensal of the sipunculid *Siphonosoma vastus*, living in silty sand (3 out of 7 specimens were discovered in association; hosts were not found for the other 4 specimens).

RECORDS. Graham Pt. – 7.

NOTES. The similarity of *Perolepis regularis* Ehlers and *Lepidasthenia sibogae* Horst to *L. stylolepis* has been referred to in an earlier paper (Gibbs, 1969).

DISTRIBUTION. Persian Gulf; ?East Africa; ?East Indies.

Lepidonotus (Thormora) jukesi (Baird, 1865)

Lepidonotus (*Thormora*) *jukesi*: Fauvel, 1953 : 37, fig. 13. o-r; Day, 1967 : 80, fig. 1.13. g-m.

HABITAT. Under coral boulders, in crevices within reef platform, amongst *Phyllochaetopterus socialis* tubes and algal cover (*Amphiroa*) from MTL to LWM.

RECORDS. Tetel Is. – 1; Matiu Is. – 13; Batuona Is. – 17; New Manra – 5; Komimbo Bay – 1; Mamara Pt. – 1; Lingatu – 2; Maramasike Pg. – 3.

DISTRIBUTION. Indo-west-Pacific.

Paradyte crinoidicola (Potts, 1910)

Polynoë crinoidicola Potts, 1910 : 337, pl. 18, fig. 10, pl. 20, fig. 30, pl. 21, figs 39–41.
Scalisetosus longicirrus: Fauvel, 1953 : 50, fig. 22. a-c; Day, 1967 : 58, fig. 1.7. a-f.
Paradyte crinoidicola: Pettibone, 1969 : 13, fig. 7. a-g.

HABITAT. A commensal of crinoids; on *Himerometra robustipinna* (P. H. Carpenter).

RECORDS. Maraunibina Is. – 5 specimens from two hosts.

NOTES. Following Fauvel (1953) and Day (1967) *P. crinoidicola* was previously referred (Gibbs, 1969) to *S. longicirrus* (Schmarda) which Pettibone (1969) considers indeterminable.

DISTRIBUTION. Indo-west-Pacific.

Paralepidonotus ampulliferus (Grube, 1878)

Polynoë ampullifera Grube, 1878 : 35, pl. 3, fig. 5.
Harmothoë ampullifera: Fauvel, 1953 : 43, fig. 18.d; Pillai, 1965 : 117, fig. 3. d-g, fig. 4. a-b.
Paralepidonotus ampulliferus: Horst, 1917 : 76; Day, 1967 : 47, fig. 1.4. a-f.

HABITAT. Undersurface of coral boulder on reef platform.

RECORD. Kalota Is. – 1.

DISTRIBUTION. Tropical Indo-west-Pacific.

Paralepidonotus indicus (Potts, 1910)

Lagisca indica Potts, 1910 : 338, pl. 19, fig. 13, pl. 21, figs 46–47.
Paralepidonotus indicus: Day, 1967 : 48, fig. 1.4. g-k.

HABITAT. Silty sand with coral debris at LWM.

RECORD. Komimbo Bay – 1.

DISTRIBUTION. Moçambique; Maldive Is.

Subfamily **POLYODONTIDAE**

Polyodontes maxillosus (Ranzani, 1817)

Polyodontes maxillosus: Fauvel, 1923 : 97, fig. 37. a-n; 1953 : 71, fig. 32. a-n.

HABITAT. Silty sand with shell and coral fragments at LWM; coarse sand at 18 m depth.

RECORDS. Graham Pt. – 1; Fintry Pt. – 1; ML 204 – 1.

NOTES. Fauvel records that this species may grow to 1 m in length. The largest of the three specimens from the Solomon Islands measures only 12 cm: its felt-like tube had a diameter 1·0 to 1·5 cm and extended to a depth of about 30 cm into the deposit at Graham Pt.

DISTRIBUTION. North Atlantic; Mediterranean; Indian Ocean; Indo-China.

Polyodontes melanonotus (Grube, 1876)

Polyodontes melanonotus: Fauvel, 1953 : 72, fig. 33. c-g; Day, 1967 : 96, fig. 1.17. g-n.

HABITAT. Mud at 11 m; coarse sand at 18 m.

RECORDS. ML 194 – 1; ML 204 – 1.

NOTES. Specimen from ML 194 is 3·5 cm long: it was removed from a tube about 15 cm in length, 1·0 cm in diameter, composed of consolidated mud.

DISTRIBUTION. West Africa; Indo-west-Pacific.

Subfamily SIGALIONINAE

Psammolyce zeylanica Willey, 1905

Psammolyce zeylanica Willey, 1905 : 255, pls 1–2, figs 33–43; Fauvel, 1953 : 68, fig 31.i.

HABITAT. Silty sand (*Thalassia* flat).

RECORDS. Graham Pt. – 2.

DISTRIBUTION. Ceylon.

Sigalion bandaënsis Horst, 1917

Sigalion bandaënsis Horst, 1917 : 110, pl. 22, figs 4–5.

HABITAT. Under boulder on silty sand with coral debris at LWM.

RECORD. Graham Pt. – 1.

DISTRIBUTION. East Indies; East Australia.

Sthenelais heterochela Horst, 1917

Sthenelais heterochela Horst, 1917 : 113, pl. 23, figs 3–6.

HABITAT. Mud and silty sand, 2–11 m depth.

RECORDS. ML 191 – 1; ML 194 – 1; ML 195 – 1.

DISTRIBUTION. East Indies.

Sthenelais zeylanica Willey, 1905

Sthenelais zeylanica Willey, 1905 : 258, pl. 2, fig. 48; Fauvel, 1953 : 62, fig. 29.a.

HABITAT. Silty sand, MTL to LWM; sand, 5–16 m depth.

RECORDS. Tetel Is. – 1; Komimbo Bay – 4; Graham Pt. – 2; Fintry Pt. – 3; ML 134 – 2; ML 190 – 1.

NOTE. In addition to the two slender stylodes arising from the base of the ventral cirrus, these specimens have a third appendage with a bulb-shaped ending.

DISTRIBUTION. India; Palau Islands.

Sthenelanella ehlersi (Horst, 1916)

Euleanira ehlersi Horst, 1916 : 12; 1917 : 122, pl. 27, figs 1–5; Day, 1967 : 101.
Sthenelanella ehlersi: Pettibone, 1969*b* : 434, figs 4–5.

Habitat. Mud and silty sand, 18–24 m depth.

Records. ML 188 – 3; ML 230 – 1.

Distribution. Natal; East Indies.

Sthenolepis japonica (McIntosh, 1885)

Leanira japonica McIntosh, 1885 : 154, pl. 22, fig. 3, pl. 14A, figs 1–2; Fauvel, 1953 : 69, fig. 33.a-b.
Sthenolepis japonica: Imajima & Hartman, 1964 : 43; Day, 1967 : 112.

Habitat. A characteristic species of fine deposits in the sublittoral zone, thick mud to silty sand, 2–33 m depth.

Records. ML 56 – 2; ML 69 – 1; ML 100 – 5; ML 155 – 2; ML 156 – 2; ML 157 – 1; ML 188 – 2; ML 190 – 2; ML 191 – 1; ML 195 – 3; ML 196 – 3; ML 218 – 4; ML 228 – 1.

Distribution. Indo-west-Pacific to Japan.

Thalenessa digitata McIntosh, 1885

Thalenessa digitata McIntosh, 1885 : 140, pl. 22, fig. 2, pl. 23, figs 5–7, pl. 25, figs 4–5, pl. 13A, figs 7–10; Willey, 1905 : 260, pl. 2, figs 50–52; Imajima & Hartman, 1964 : 46.

Habitat. Coarse sand, 2–4 m depth.

Records. ML 203 – 2; ML 296 – 1.

Distribution. Ceylon; Admiralty Is.; Japan.

Family **PALMYRIDAE**

Bhawania goodei Webster, 1884

Bhawania cryptocephala Gravier, 1901 : 263, pl. 10, figs 152–156, text-figs 280–285; Fauvel, 1953 : 79, fig. 36. e-i.
Bhawania goodei: Day, 1953 : 407 (synonymy); 1967 : 118, fig. 2.1. a-f.

Habitat. Cohabiting burrows of coral-boring sipunculids; hosts include *Aspidosiphon elegans* (Chamisso & Eysenhardt), *Cloeosiphon aspergillum* (Quatrefages) and *Phascolosoma albolineatum* (Baird). Also found free-living in crevices and amongst tubes of *Phyllochaetopterus socialis*.

Records. Matiu Is. – 30; New Manra – 5; Mamara Pt. – 1; Maramasike Pg. – 2.

Distribution. Circumtropical.

Bhawania pottsiana Horst, 1917

Bhawania cryptocephala: Potts, 1910 : 328.
Bhawania cryptocephala var. *pottsiana* Horst, 1917 : 137.
Bhawania sp.: Gibbs, 1969 : 454.

HABITAT. Sedimented crevices in *Porites* boulders; commensal (?) with *Eurythoë complanata* (see Gibbs, 1969).

RECORDS. Graham Pt. – 2.

NOTES. The larger of the two specimens measures 45 mm in length. Both possess very slender setae with hair-like appendices in the inferior part of the neuropodium, which are not present in *B. goodei*. This additional type of seta was first noticed by Potts (1910) in a specimen from Zanzibar which he attributed to *B. cryptocephala*. However Horst (1917), in recording a similar specimen from the Celebes Is., gave this form varietal status, naming it *B. cryptocephala* var. *pottsiana*. Day (1953) has shown *B. cryptocephala* to be a synonym of *B. goodei*, but since the variety *pottsiana* is quite distinct from its stem species, its subspecific status is here raised to specific rank.

DISTRIBUTION. Zanzibar; East Indies.

Paleanotus debilis (Grube, 1855)

Paleanotus debilis: Day, 1962 : 635 (synonymy); 1967 : 117, fig. 2.1. g-k.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes at LWM; on *Halichondria* sp. at 5 m depth.

RECORDS. Matiu Is. – 1; Batuona Is. – 1; Yandina – 2.

DISTRIBUTION. North Atlantic; Mediterranean; Indo-Pacific.

Family **AMPHINOMIDAE**

Amphinome nigrobranchiata Horst, 1912

Amphinome nigrobranchiata Horst, 1912 : 39, pl. 10, figs 17–20.

HABITAT. Under coral boulders; in shell gravel deposits.

RECORDS. Tetel Is. – 2; Graham Pt. – 2; Maraunibina Is. – 1.

DISTRIBUTION. East Indies.

Chloeia conspicua Horst, 1910

Chloeia conspicua Horst, 1910 : 173; 1912 : 20, pl. 7, fig. 5, pl. 8, figs 4–5.

HABITAT. Silty sand at 2 m depth.

RECORD. ML 196 – 1.

DISTRIBUTION. East Indies.

Euphrosine foliosa Audouin & Milne-Edwards, 1833

Euphrosine foliosa: Fauvel, 1923 : 136, fig. 49. a-g; 1953 : 102, fig. 48. a-h.

HABITAT. Under coral boulder at LWM.

RECORD. Maraunibina Is. – 1.

DISTRIBUTION. Atlantic Ocean; Mediterranean; Indo-west-Pacific.

Euphrosine myrtosa Savigny, 1818

Euphrosine myrtosa: Fauvel, 1923 : 139, fig. 49. k-n; 1953 : 101, fig. 48. k-n; Day, 1967 : 127, fig. 3.1.z.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes; sedimented crevice in *Porites* boulder.

RECORDS. Batuona Is. – 1; Graham Pt. – 1.

DISTRIBUTION. West Africa; Mediterranean; Indo-west-Pacific.

Eurythoë complanata (Pallas, 1766)

Eurythoë complanata: Fauvel, 1953 : 83, fig. 38. b-m; Day, 1967 : 128, fig. 3.2. a-h.

HABITAT. A wide variety of situations, including under coral boulders, in crevices in reef platform and in beachrock, in *Acropora* rubble and amongst *Phyllochaetopterus socialis* tubes and *Amphiroa*.

RECORDS. Tetel Is. – 10; Komimbo Bay – 20; Matiu Is. – num.; Batuona Is. – num.; New Manra – 1; Graham Pt. – 6; Maraunibina Is. – 5; Lauvie Is. – 1.

DISTRIBUTION. Circumtropical.

?***Eurythoë*** sp.

HABITAT. Under coral boulders in silty sand.

RECORDS. Maraunibina Is. – 4.

NOTES. The specimens measure between 10 and 20 mm long and about 2 mm wide and have 57 to 67 segments. A sinuous caruncle extends through setiger 2 and the branchiae commence between setigers 9 and 13, extending to the posterior end. Notosetae are of three types, namely (i) stout spines, (ii) harpoon setae and (iii) long, fine, smooth capillaries. Neurosetae are of two types – (i) furcate, with a short secondary spur and (ii) long, fine capillaries with faintly serrated blades, some with a stout spur.

The generic identity of these specimens is in question since in the genus *Eurythoë* the branchiae commence on setigers 1–3 (Day, 1967). It is possible that these relatively small specimens are juveniles and because of this, the erection of a new genus must be postponed until further material is available.

Notopygos gregoryi Holly, 1939

Notopygos gregoryi Holly, 1939 : 265, fig. 1. a-f.

HABITAT. Not known.

RECORD. Fanalei – 1.

NOTES. The specimen of this elegant species was collected during the 'palolo' rising at Fanalei between 2000 and 2200 hours on 2.xi.66. It is 160 mm long and 25 mm across the body. All details correspond to the description of the holotype.

DISTRIBUTION. Midway Is. (one specimen).

Notopygos sibogae Horst, 1911

Notopygos sibogae Horst, 1911 : 245; 1912 : 27, pl. 9, figs 4–5.

HABITAT. In *Acropora* rubble; within sedimented crevices on the undersurfaces of *Porites* boulders.

RECORDS. Tetel Is. – 1; Graham Pt. – 3.

NOTES. Hartman (1966) comments that the differences in the specific characters in *Notopygos* i.e. number of segments and the position of the anal pore, may reflect differences in the growth stages. However in all four specimens in the collection of *N. sibogae* the anal pore is situated on the anterior margin of setiger 23 although the lengths vary from 10 to 20 mm.

DISTRIBUTION. East Indies.

Pareurythoë pitipanaensis De Silva, 1965

Pareurythoë pitipanaensis De Silva, 1965 : 540, fig. 3. a-k.

HABITAT. Under coral boulders, in shell gravel and within the interstices of the coral *Galaxea*.

RECORDS. Tetel Is. – 1; Graham Pt. – 5; Maraunibina Is. – 3.

DISTRIBUTION. Ceylon.

Pseudeurythoë paucibranchiata Fauvel, 1932

Pseudeurythoë paucibranchiata Fauvel, 1932 : 47, pl. 1, figs 3–4, text-fig. 8. a-e; 1953 : 86, fig. 39. a-b, fig. 40. a-e.

HABITAT. In silty deposits, particularly under coral boulders; in *Acropora* rubble; in muds and fine sands, 2–26 m depth.

RECORDS. Tetel Is. – 3; Komimbo Bay – 12; Graham Pt. – 7; Maraunibina Is. – 4; ML 37 – 2; ML 41 – 1; ML 68 – 1; ML 96 – 1; ML 110 – 15; ML 134 – 1; ML 156 – 3; ML 157 – 6; ML 194 – 1; ML 195 – 1; ML 218 – 1; ML 228 – 4.

NOTES. Most of the specimens show a button-like caruncle set into the first setiger but some are so contracted that this feature is not visible. Small specimens about 5 mm in length have 4 or 5 pairs of branchiae, whilst in medium-sized specimens up to 10 mm long, the branchiae continue to setiger 16 or 17. The largest specimens come from the littoral zone (Marau Sound); these measure 35 mm long and have branchiae up to setiger 27, as typical for *P. paucibranchiata*.

There is some doubt as to whether all of the specimens in this series should be referred to *P. paucibranchiata* since the position of the prostomium in relation to the first segments and the presence of a caruncle, two major specific characters, are difficult to determine in strongly contracted specimens. Further, the number of branchiae varies greatly with size and cannot be regarded as specific, particularly in small specimens. The setae also are not diagnostic, according to Wesenberg-Lund (1949). On account of these considerations, it seems probable that a number of *Pseudeurythoë* species are synonyms of *P. oculifera* (Augener), the description of which was based on a small, probably juvenile, specimen.

DISTRIBUTION. Indian Ocean; Indo-China.

Family **PHYLLODOCIDAE**

Eteone japanensis McIntosh, 1901

Eteone japanensis McIntosh, 1901 : 222, pl. 1, fig. 2; Imajima & Hartman, 1964 : 60.,

HABITAT. Silty sand.

RECORD. Tetel Is. – 1.

NOTES. The specimen agrees with those details given in the type description and, in addition, possesses a smooth proboscis. However, since the characters of the proboscis in this species are unknown the identification must be regarded as a provisional one.

DISTRIBUTION. Japan Sea.

Eulalia albopicta Marenzeller, 1879

Eulalia albopicta Marenzeller, 1879 : 128, pl. 3, fig. 3; Fauvel, 1953 : 123, fig. 60. a-b.

HABITAT. Cohabiting a *Phyllochaetopterus elioti* tube from silty sand.

RECORD. Fintry Pt. – 1.

DISTRIBUTION. Indian Ocean; Indo-China; Japan.

Eulalia viridis (Linnaeus, 1767)

Eulalia viridis: Fauvel, 1923 : 160, fig. 57. a-h; 1953 : 122, fig. 6.1. a-h; Imajima & Hartman, 1964 : 63.

HABITAT. Crevice in reef platform.

RECORD. Maramasike Pg. – 1.

DISTRIBUTION. Cosmopolitan.

Eulalia (Pterocirrus) magalhaensis Kinberg, 1866

Eulalia (*Pterocirrus*) *magalhaensis*: Kinberg 1858–1910 : 55, pl. 33, fig. 1; Fauvel, 1953 : 124, fig. 62. a-h.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes and algal growth (*Amphiroa*) towards LWM.

RECORDS. Cape Esperance – 1; Matiu Is. – 2; Batuona Is. – 1; New Manra – 1.

NOTE. All five specimens are small-sized (3 to 7 mm) but conform to the species description.

DISTRIBUTION. Indo-Pacific.

Notophyllum splendens (Schmarda, 1861)

Macrophyllum splendens Schmarda 1861 : 82, pl. 29, fig. 227.
Notophyllum splendens: Fauvel, 1953 : 126, fig. 60. c; Day, 1967 : 151, fig. 5.3. k-n.

HABITAT. Under coral boulder; interstices of the coral *Galaxea*.

RECORDS. Graham Pt. – 2.

DISTRIBUTION. Indo-west-Pacific.

Phyllodoce fristedti Bergström, 1914

Phyllodoce fristedti: Fauvel, 1953 : 118, fig. 58. a-b; Day, 1967 : 147, fig. 5.2. k-m.

HABITAT. Crevices in reef platform and beachrock.

RECORDS. Matiu Is. – 1; Lauvie Is. – 1.

DISTRIBUTION. Indian Ocean.

Phyllodoce malmgreni Gravier, 1900

Phyllodoce malmgreni Gravier, 1900 : 207, pl. 10, figs 29–31, text-figs 66–69; Fauvel, 1953 : 117, fig. 56. h; Day, 1967 : 147, fig. 5.2. n-p.

HABITAT. Silty sand at MTL; mud at 2 m depth.

RECORDS. Tetel Is. – 2; ML 68 – 1.

DISTRIBUTION. Indian Ocean; East Australia.

Phyllodoce pruvoti Fauvel, 1930

Phyllodoce pruvoti Fauvel 1930 : 512, fig. 1. a-f, fig. 2. a-c; 1947 : 28, fig. 23.

HABITAT. Crevices in reef platform; amongst *Phyllochaetopterus socialis* tubes.

RECORDS. Matiu Is. – 1; Batuona Is. – 1; New Manra – 1.

DISTRIBUTION. Tropical West Pacific.

Phyllodoce quadraticeps Grube, 1878

Phyllodoce quadraticeps Grube, 1878 : 98, pl. 6, fig. 2; Fauvel, 1953 : 116, fig. 56. f-j; Day, 1967 : 145, fig. 5.2. h-j.

HABITAT. Crevices in reef platform and in beachrock, MTL to LWM.

RECORDS. Kokomtambu Is. – 1; Matiu Is. – 10; Lauvie Is. – 1.

NOTE. This species is often found crawling over the surface of exposed coral during the low-tide period.

DISTRIBUTION. Tropical Indo-west-Pacific.

Phyllodoce (Anaitides) madeirensis Langerhans, 1880

Phyllodoce (*Anaitides*) *madeirensis*: Fauvel, 1953 : 120, fig. 59. d-h; Day, 1967 : 145, fig. 5.2. d-g.

HABITAT. In *Acropora* rubble, under coral boulders and in beachrock crevices.

RECORDS. Komimbo Bay – 2; Lauvie Is. – 2; Graham Pt. – 2; Fanalei – 3.

NOTES. The Fanalei specimens were collected between 1830 and 1900 hours during the 'palolo' rising on 2.xi.66 and are 'spent'. Local name is 'adio'.

DISTRIBUTION. Cosmopolitan.

Phyllodoce (Anaitides) parva (Hartmann – Schröder, 1965)

Anaitides parva Hartmann – Schröder, 1965 : 88, figs 7–9; Hartman, 1966 : 183.

Habitat. Medium sand at 5 m.

Record. ML 190 – 1.

Distribution. Hawaii.

Phyllodoce (Genetyllis) castanea (Marenzeller, 1879)

Carobia castanea Marenzeller, 1879 : 127, pl. 3, fig. 2; Izuka, 1912 : 199, pl. 21, fig. 3.
Phyllodoce (*Genetyllis*) *castanea*: Fauvel, 1953 : 115, fig. 56. a-c; Day, 1967 : 149, fig. 53. d-f.

Habitat. Sand at 11 m.

Record. ML 98 – 1.

Distribution. Indo-west-Pacific.

Phyllodoce (Genetyllis) gracilis Kinberg, 1866

Phyllodoce gracilis: Kinberg, 1858–1910 : 55, pl. 22, fig. 3; Monro, 1939 : 173, fig. 3. a-c; Fauvel, 1953 : 117, fig. 57. a-g.

Habitat. Crevice in reef platform.

Record. Lingatu – 1.

Distribution. Tropical Indo-Pacific.

Family **PILARGIDAE**

Sigambra hanaokai (Kitamori, 1960)

Ancistrosyllis hanaokai Kitamori, 1960a : 1086, fig. 1. a-h.
Sigambra hanaokai: Pettibone, 1966 : 181 (synonymy).

Habitat. Mud, 2–20 m depth.

Records. ML 39 – 3; ML 40 – 1; ML 41 – 10; ML 68 – 5; ML 157 – 1.

Notes. Larger specimens – up to 14 mm in length – were found inhabiting thin membraneous tubes covered in mud particles.

Distribution. Japan.

Synelmis albini (Langerhans, 1881)

Ancistrosyllis rigida Fauvel, 1919 : 337, fig. 1. a-e; 1953 : 110, fig. 53. a-e; Day, 1967 : 215.
Synelmis albini: Pettibone, 1966 : 191, figs 19–21 (synonymy).

HABITAT. Crevices in reef platform; amongst *Phyllochaetopterus socialis* tubes; in shell gravel and coarse sand.

RECORDS. Komimbo Bay – 2; Matiu Is. – 1; Batuona Is. – 4; Mamara Pt. – 1; Graham Pt. – 1; Maramasike Pg. – 1.

DISTRIBUTION. Circumtropical.

Family **HESIONIDAE**

Gyptis capensis (Day, 1963)

Oxydromus capensis Day, 1963 : 397, fig. 4. e-j.
Gyptis capensis: Day, 1967 : 231, fig. 11.2. l-o.

HABITAT. Under coral boulders on silty sand, MTL to LWM.

RECORDS. Maraunibina Is. – 3.

NOTES. A complete specimen measures 15 mm in length for about 70 segments. Notosetae are present from setiger 5.

DISTRIBUTION. South Africa.

Gyptis maraunibinae n. sp.

(Fig. 5. A–F)

DISTRIBUTION. The holotype is 45 mm long for 150 segments and the body is about 3 mm wide.

The prostomium is rectangular, its width being about 1·5 times the length (fig. 5. A). Three antennae arise from the anterior margin of the prostomium; the laterals are about twice the length of the median. The two biarticulate palps, each composed of a short palpostyle and longer palpophore, are stouter and slightly longer than the lateral antennae. There are two pairs of eyes and those of the anterior pair are reniform in shape and are larger than those of the posterior pair. The proboscis carries ten papillae, each of which is broad and flap-like (fig. 5. B). Jaws are lacking, but there is a horny rim around the ventral and ventro-lateral margins of the proboscis.

The tentacular cirri number eight pairs and each is faintly but closely annulated. The dorsal pair of the second segment is the longest, reaching back to about setiger 15.

The first 4 or 5 setigers are uniramous, becoming biramous when a notopodial papilla appears on the antero-ventral side of the cirrophore from about setiger 6. The notopodia are small throughout the length of the body but the neuropodia are well developed, each with a pointed pre-setal lip and a rounded post-setal lip (fig. 5. C). Ventral cirri are about equal to the neuropodial lobe in length. In the middle of the body, notosetae include 2 or 3 rather stout, smooth spines (fig. 5. E) and 4 or 5 forked setae (fig. 5. D); neurosetae are falcigerous, each with a minutely serrated blade of varying length and with a bidentate tip consisting of a strong terminal tooth and a slender secondary one (fig. 5. F).

The large, lobular, papillae on the proboscis are sufficient to distinguish *G. maraunibinae* from other *Gyptis* species. In other details the species resembles *G. capensis* (Day).

HABITAT. Silty sand with shell gravel below coral boulder on reef platform.

RECORD. Graham Pt. – 1.

British Museum (Natural History) Registration No. Holotype 1970·29

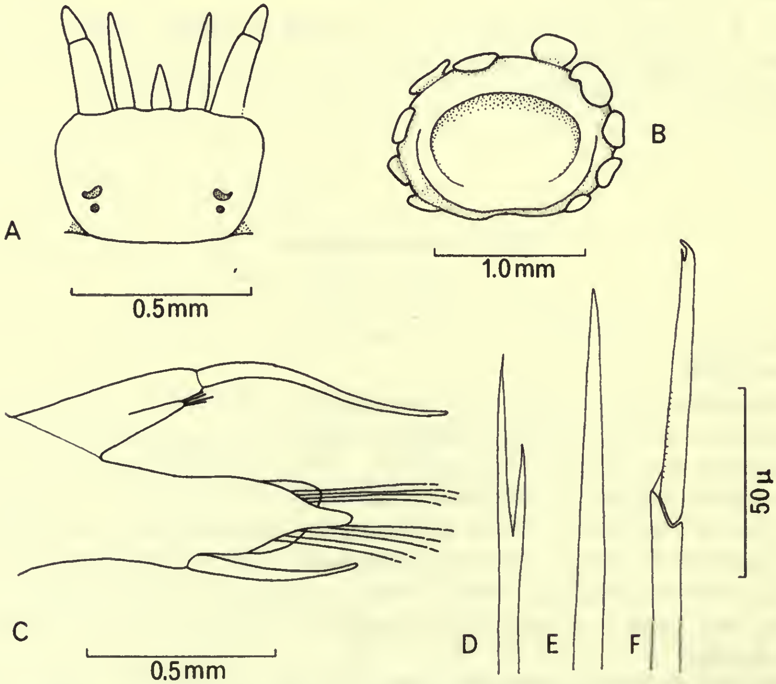

FIG. 5. *Gyptis maraunibinae* n.sp. (A) Dorsal view of prostomium. (B) Anterior view of proboscis. (C) Parapodium from middle body. (D–E) Notopodial forked seta and spine. (F) Neuropodial falciger.

Hesione splendida Savigny, 1818

Hesione pantherina: Fauvel, 1953 : 104, fig. 49. a-g.
Hesione splendida: Day, 1967 : 228, fig. 11.2. a-c.

HABITAT. In *Acropora* rubble and shell gravel; in crevices and under coral boulders.

RECORDS. Honiara – 1; Komimbo Bay – 1; Graham Pt. – 14.

DISTRIBUTION. North Atlantic; Mediterranean; Indo-west-Pacific.

Leocrates chinensis Kinberg, 1866

Leocrates claparedii: Fauvel, 1953 : 106, fig. 50. c-g; Day, 1967 : 230, fig. 11.2. g-k.
Leocrates chinensis: Imajima & Hartman, 1964 : 82 (synonymy).

HABITAT. In shell gravel and *Acropora* rubble; under coral boulders.

RECORDS. Kokomtambu Is. – 1; Tetel Is. – 4; Komimbo Bay – 1; Fintry Pt. – 1; Maramasike Pg. – 1.

DISTRIBUTION. West Africa; Mediterranean; tropical Indo-west-Pacific.

Family **SYLLIDAE**

The species listed below for this family were identified by Dr. Minoru Imajima. A detailed account of this material will be published by Dr. Imajima at a later date.

Subfamily **AUTOLYTINAE**

Autolytus sp.

HABITAT. On sponge *Halichondria* sp. at 5 m depth.

RECORD. Yandina – 1 (damaged).

Subfamily **EXOGONINAE**

Brania clavata (Claparède, 1863)

Grubea clavata: Fauvel, 1923 : 296, fig. 114 a-e.
Brania clavata: Imajima, 1966 : 393, fig. 1 a-g.

HABITAT. Coarse sand at LWM.

RECORD. Komimbo Bay – 1.

DISTRIBUTION. North Atlantic; Mediterranean; Japan.

Exogone gemmifera Pagenstecher, 1862

Exogone gemmifera: Fauvel, 1923 : 305, fig. 117. a-d; Imajima, 1966 : 397, fig. 2. a-h; Day, 1967: 274, fig. 12.10. p-u.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes at LWM.

RECORD. Matiu Is. – 1.

DISTRIBUTION. North Atlantic; South Africa; Mediterranean; Japan; northern North Pacific.

Exogone uniformis Hartman, 1961

Exogone uniformis Hartman, 1961 : 73, pl. 6, fig. 1, pl. 7, figs 1–4; Imajima, 1966 : 400, fig. 4. a-j.

HABITAT. Coarse sand and silty fine coral sand at LWM.

RECORDS. Komimbo Bay – 1; Matiu Is. – 1.

DISTRIBUTION. Southern California; Japan.

Exogone verugera (Claparède, 1868)

Exogone verugera: Fauvel, 1923 : 307, fig. 117. m-r; Imajima, 1966 : 399, fig. 3. a-h; Day, 1967 : 272, fig. 12.10. g-l.

HABITAT. On *Eunice tubifex* tube at LWM; on sponge *Halichondria* sp. at 5 m depth.

RECORDS. Tetel Is. – 1; Yandina – 1.

DISTRIBUTION. North Atlantic; Mediterranean; South Africa; S.W. and E. Australia; North Pacific.

Sphaerosyllis hirsuta Ehlers, 1897

Sphaerosyllis hirsuta Ehlers, 1897 : 48, pl. 3, figs 58–60; Imajima & Hartman, 1964 : 117, pl. 27, figs f-l; Imajima, 1966 : 404.

HABITAT. Coarse sand at LWM; on *Eunice tubifex* tube at LWM.

RECORDS. Komimbo Bay – 1; Tetel Is. – 1.

DISTRIBUTION. Northern North Pacific; Japan; Australia; New Zealand; southern South America.

Subfamily SYLLINAE

Haplosyllis spongicola (Grube, 1855)

Syllis (*Haplosyllis*) *spongicola*: Fauvel, 1923 : 257, fig. 95. a-d; 1953 : 147, fig. 75. a-d; Day, 1967 : 240, fig. 12.1. e-i.
Haplosyllis spongicola: Imajima, 1966a : 220, fig. 38. a-h.

HABITAT. Abundant in sponges – *Neofolitispa dianchora* and *Halichondria* sp. – from 5 m depth.

RECORDS. Yandina – num.

DISTRIBUTION. Cosmopolitan in tropical and temperate waters.

Langerhansia cornuta (Rathke, 1843)

Syllis (*Ehlersia*) *cornuta*: Fauvel, 1923 : 267, fig. 100 g-i; 1953 : 153, fig. 79. g-i.
Syllis (*Langerhansia*) *cornuta*: Day, 1967 : 244, fig. 12.2. s-u.
Langerhansia cornuta: Imajima, 1966b : 256, fig. 51. a-o.

HABITAT. Coarse sand, silt; on sponge *Halichondria* sp. at 5 m depth.

RECORDS. Tetel Is. – 3; Komimbo Bay – 19; Yandina – 1.

DISTRIBUTION. Atlantic; Indo-Pacific.

Langerhansia ?rosea (Langerhans, 1879)

Langerhansia rosea: Imajima, 1966b : 259, fig. 52. a-m.

HABITAT. On serpulid tubes at MTL; coarse sand at LWM.

RECORDS. Tetel Is. – 1; Komimbo Bay – 2.

Syllis longissima Gravier, 1900

Syllis longissima Gravier, 1900 : 154, pl. 9, fig. 7, text-figs. 17–23; Day, 1967 : 243, fig. 12.2. f-i

HABITAT. Crevices in reef platform; amongst *Phyllochaetopterus socialis* tubes at LWM.

RECORDS. Matiu Is. – 8; New Manra – 1; Lingatu – 3.

NOTE. This appears to be the first record of *S. longissima* in the west Pacific region.

DISTRIBUTION. Red Sea; Persian Gulf; west coast of South America.

Syllis sp. cf. ***gracilis*** Grube, 1840

Syllis gracilis: Fauvel, 1923 : 259, fig. 96. f-i; 1953 : 147, fig. 73. f-i; Imajima, 1966a : 248, fig. 49. a-k; Day, 1967 : 241, fig. 12.1. m-p.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes at LWM; on sponge *Halichondria* sp. at 5 m depth.

RECORDS. Batuona Is. – 3; Yandina – 1.

Trypanosyllis coeliaca Claparède, 1868

Trypanosyllis coeliaca: Fauvel, 1923 : 270, fig. 101. f-h.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes at LWM.

RECORD. Batuona Is. – 1.

NOTE. Previous records of *T. coeliaca* are confined to western Europe and the Mediterranean Sea.

DISTRIBUTION. North Atlantic; Mediterranean.

Trypanosyllis **(*Trypanedenta*)** sp.

HABITAT. Crevices in beachrock at LWM.

RECORDS. Lauvie Is. – 3.

Typosyllis alternata (Moore, 1908)

Typosyllis alternata: Imajima, 1966b : 273, fig. 58. a-l.

HABITAT. Chiefly amongst *Phyllochaetopterus socialis* tubes; under boulders and in crevices in reef platform; on sponge *Neofolitispa dianchora* at 5 m depth.

RECORDS. Tetel Is. – 2; Matiu Is. – 5; Cape Esperance – 3; Batuona Is. – 6; Yandina – 3.

DISTRIBUTION. Japan; East Indies; west coast of North America.

Typosyllis armillaris (Müller, 1776)

Syllis (*Typosyllis*) *armillaris*: Fauvel, 1923 : 264, fig. 99. a-f; Day, 1967 : 249, fig. 12.4. a-d.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes at LWM.

RECORDS. Batuona Is. – 2.

DISTRIBUTION. Cosmopolitan.

Typosyllis brachycola (Ehlers, 1897)

Syllis brachycola Ehlers, 1897 : 38, pl. 2, figs 46–47.
Syllis (*Typosyllis*) *brachychola*: Augener, 1924 : 362.

HABITAT. Below boulders in silty sand; amongst *Phyllochaetopterus socialis* tubes; interstices of coral *Galaxea*.

RECORDS. Tetel Is. – 1; Naro Bay – 2; Batuona Is. – 3; Graham Pt. – 2.

NOTE. *T. brachycola* is widely distributed in the southern temperate and subantarctic regions but this appears to be the first record from tropical waters.

DISTRIBUTION. Southern South America; New Zealand.

Typosyllis exilis (Gravier, 1900)

Syllis (*Typosyllis*) *exilis* Gravier, 1900 : 160, pl. 9, fig. 9, text-figs 28–30; Day, 1967 : 250, fig. 12.4. h-j.

HABITAT. Crevice in reef platform at MTL.

RECORD. Mamara Pt. – 1.

DISTRIBUTION. Indo-west-Pacific to Gambier Islands.

Typosyllis lucida (Chamberlin, 1919)

Pionosyllis lucida Chamberlin, 1919 : 8.
Typosyllis lucida: Hartman, 1968 : 489.

HABITAT. Crevices in reef platform.

RECORDS. Kokomtambu Is. – 1; Matiu Is. – 2.

NOTE. This species has not been recorded since it was first described by Chamberlin from Laguna Beach, California.

DISTRIBUTION. Southern California.

Typosyllis prolifera (Krohn, 1852)

Syllis (*Typosyllis*) *prolifera*: Fauvel, 1923 : 261, fig. 97. a-g; 1953 : 149, fig. 74. a-g; Day, 1967 : 248, fig. 12.3. g-i.
Typosyllis prolifera: Imajima, 1966b : 292, fig. 65. a-n.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes at LWM; on sponge *Halichondria* sp. at 5 m depth.

RECORDS. Batuona Is. – 1; Yandina – 2.

DISTRIBUTION. North Atlantic; Mediterranean; South Africa; Indo-west-Pacific.

Typosyllis sp.

Habitat. On sponge *Halichondria* sp. at 5 m depth.

Record. Yandina – 1.

Family SPHAERODORIDAE

Sphaerodoridium claparedii (Greeff, 1866)

Sphaerodorum claparedii: Fauvel, 1923 : 379, fig. 149. d-e.
Sphaerodoridium claparedii: Lützen, 1961 : 415.

Habitat. On sponge *Halichondria* at 5 m depth.

Record. Yandina – 1.

Notes. This specimen was overlooked during the primary sorting of a collection of polychaetes from sponges and was included in a large sample of syllids sent to Dr. M. Imajima who kindly identified it. This record considerably extends the known distribution of *S. claparedii* which hitherto was recorded only from western Europe.

Distribution. European waters.

Family NEREIDAE

Subfamily NAMANEREINAE

Cryptonereis n. gen.

Small nereids that are generally similar to *Namanereis* but which lack frontal antennae. Prostomium with two pairs of eyes and two biarticulate palps. Proboscis without paragnaths but with a pair of toothed jaws. Peristomium with three pairs of tentacular cirri but not parapodia. Parapodia are sesquiramous throughout, each lacking a notopodial lobe but with a notopodial aciculum. Superior neuropodial setae are spinigerous, the rest being falcigerous. At maturity, parapodia become biramous with the development of capillary setae.

Type species. *Cryptonereis malaitae* Gibbs.

Cryptonereis malaitae n. gen. n. sp.

Fig. 6. (a–f)

Description. Larger specimens measure between 10 and 15 mm long for 55 to 65 segments and are about 2 mm wide.

The prostomium is rounded, roughly semi-circular in shape, with two pairs of eyes and two biarticulate palps with broad palpophores. Frontal antennae are lacking (fig. 6. A). The peristomium carries three pairs of short tentacular cirri; on each side two cirri are attached to a short base which is ventro-lateral in position and the third cirrus arises dorso-laterally on the peristomium (fig. 6. B). The proboscis lacks paragnaths but carries a pair of brown jaws, each with 9 or 10 teeth and a thin internal guard (fig. 6. C).

The parapodia are sesquiramous in immature individuals, becoming biramous over most of the body when mature (see below). Notopodial lobes are lacking but black notopodial as well as neuropodial acicula persist (fig. 6. D). Neuropodia are bilobed with pointed pre-setal and rounded post-setal lips. The dorsal cirri are short and stout and the ventral cirri are very small.

The neuropodial setae consist of one or two spinigers with minutely serrated blades (fig. 6. E) and four or five falcigers with short ciliated blades (fig. 6. F). The shaft and blade of the superior falciger often appear to be fused but the articulations of the other falcigers are usually distinct.

Most of the specimens appear to be approaching maturity and, on preservation, gametes have been released from the parapodia at points just above the dorsal cirri.

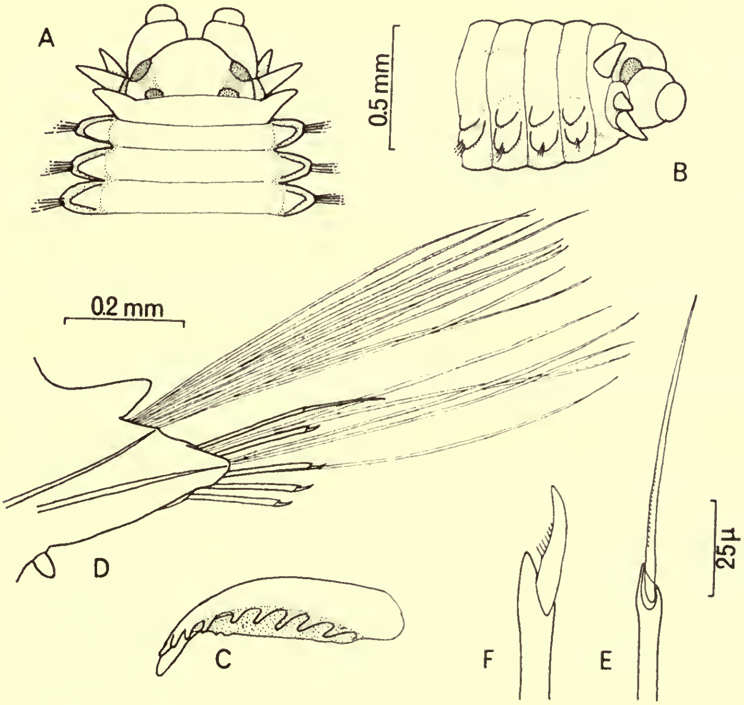

Fig. 6. *Cryptonereis malaitae* n.gen., n.sp. (A–B) Dorsal and lateral views of anterior region. (C) Left jaw in ventral view. (D) Parapodium from middle body of mature specimen. (E) Spiniger. (F) Falciger.

In these specimens, long, slender capillary setae are present in both rami of the parapodia from setigers 8 or 9 to the last few segments. In some, these capillary setae are short and few in number but in others, probably at a more advanced stage of maturity, they are very much longer, being about three times the length of the falcigers. In the latter specimens, each parapodium has a compact notopodial bundle, composed of about 20 capillaries, arising from between the dorsal cirrus and the notopodial aciculum, and a further 8 to 10 capillaries appear amongst the neurosetae (fig. 6. D). The specimen chosen for the holotype shows this condition.

In the collection there is an immature individual which is only 6·5 mm long for 35 segments (incomplete). This specimen does not possess the capillary setae found in the larger specimens. It is thought therefore that *C. malaitae* has an epitokous phase at maturity in which capillary (or natatory) setae (recalling those that are formed in the epitokes of some Syllidae) are developed and that the majority of the type specimens, collected on 20.xi.65, are approaching, or at, this stage of development.

C. malaitae is apparently dioecious. The oocytes are yolky and those released on preservation by the females vary greatly in size but are mainly between 100 to 150μ in diameter. Spermatozoa are recognizable in the coelomic contents of the more mature males. In life, specimens are purplish but assume a brownish colour in alcohol.

It seems inadvisable to enlarge the generic description of the relatively well-known and widespread genus *Namanereis* Chamberlin (see Hartman, 1959*a*) to include those forms which lack frontal antennae, hence the need to erect a new genus. Apart from its lacking frontal antennae and also its possession of capillary setae at maturity, *Cryptonereis* closely resembles *Namanereis* and the relationship between these two genera parallels that between *Micronereis* Claparède and *Micronereides* Day in terms of the presence or absence of antennae.

HABITAT. Between the fibres composing a leaf frond of the coconut palm found stranded at about MTL.

RECORDS. Alite Harbour, Langa-Langa Lagoon (Malaita) – 14.

British Museum (Natural History) Registration No. Holotype 1970·30
Paratypes 1970·31

NOTES. It is difficult to decide whether the habitat of *C. malaitae* is marine or, like many other Namanereinae, damp-terrestrial since either is possible, depending on the period of time the leaf frond had been immersed in seawater. Interestingly, further specimens of this, or a closely related species, were collected by the Expedition Land Party (Mr. J. Peake and Dr. J. Greenslade) in moist leaf litter at an altitude of about 350 m at two separate localities, namely Betimatu on Mt. Austen, Guadalcanal and on Kolombangara in the New Georgia Group. This material consists of two specimens (one incomplete and the other dried) both about 5 mm long and resembling immature *C. malaitae* in detail. However in both specimens the prostomium is damaged and because the presence or absence of frontal antennae cannot be determined their identity must remain in question. It is possible that these two specimens could be *Namanereis amboinensis* (Pflugfelder, 1933, as *Lycastopsis amboinensis*) which resembles the immature stage of *C. malaitae* in all details but possesses antennae.

Namalycastis indica (Southern, 1921)

Lycastis indica Southern, 1921 : 578, pl. 19, fig. 2. a-j, text-fig. 2. a-d.
Namalycastis indica: De Silva, 1965a : 5, fig. 2. a-e; Day, 1967 : 301, 14.2. p-s.

HABITAT. Burrowing within the fibrous husks of *Nipa* palm nuts immersed in brackish water (5·6 ‰).

RECORD. Lagoon at the mouth of the Lunga R. at Lunga Pt. – 12.

NOTES. *N. indica* was found only in those *Nipa* nuts which were waterlogged, lying along and just below the water-line of the swamp. The largest specimen is 60 mm long.

DISTRIBUTION. Indian Ocean.

Subfamily **NEREINAE**

Ceratonereis costae (Grube, 1840)

Ceratonereis costae: Fauvel, 1923 : 349, fig. 136. a-f; 1953, 194, fig. 98. a-f; Day, 1967 : 325, fig. 14.10. h-l.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes; on *Halichondria* sp. at 5 m depth.

RECORDS. Batuona Is. – 1; Yandina – 1.

DISTRIBUTION. North Atlantic; Mediterranean; Indo-west-Pacific.

Ceratonereis erythraeënsis Fauvel, 1918

Ceratonereis erythraeënsis Fauvel, 1918 : 505, fig. 2. a-k; Day, 1967 : 327, fig. 14.10. o-t.

HABITAT. Muddy silt under boulders at MTL.

RECORDS. Naro Bay – 20.

DISTRIBUTION. Indian Ocean; East Australia; Japan.

Ceratonereis mirabilis Kinberg, 1866

Ceratonereis mirabilis: Gravier, 1901 : 172, pl. 11, fig. 42; Fauvel, 1953 : 200, fig. 103. a-c; Day, 1967 : 324, fig. 14.10. a-g.

HABITAT. Silty sand under boulders; in *Acropora* rubble; within interstices of *Galaxea*; on *Halichondria* sp. at 5 m depth.

RECORDS. Tetel Is. – 2; Komimbo Bay – 1; Graham Pt. – 2; Yandina – 3.

DISTRIBUTION. Circumtropical.

Nereis (Neanthes) caudata (Delle Chiaje, 1825)

Nereis cricognatha: Fauvel, 1953 : 180, fig. 91. a-c.
Nereis (*Neanthes*) *arenaceodonta*: Pettibone, 1963 : 162, figs 44.i, 45.e.
Nereis (*Neanthes*) *caudata*: Day, 1967 : 321, fig. 14.9. f-j.

HABITAT. Under coral boulder in muddy silt; sand at 5 m depth.

RECORDS. Komimbo Bay – 1; ML 229 – 1.

DISTRIBUTION. Cosmopolitan.

Nereis (Neanthes) unifasciata Willey, 1905

Nereis (*Neanthes*) *unifasciata* Willey, 1905 : 271, pl. 4, figs 85-88; Fauvel, 1953 : 182, 92. a-h; Day, 1967 : 318, fig. 14.7. u-y.

HABITAT. Under coral boulder; in beachrock.

RECORDS. Komimbo Bay – 1; Lauvie Is. – 1.

DISTRIBUTION. Tropical Indo-west-Pacific.

Nereis (Neanthes) sp. cf. *kerguelensis* McIntosh, 1885

Nereis kerguelensis McIntosh, 1885 : 225, pl. 35, figs 10–12, pl. 16A, figs 17–18.

HABITAT. Silty sand in crevice of *Porites* boulder.

RECORD. Graham Pt. – 1.

NOTES. The specimen corresponds to *N. kerguelensis* in all details except that the notopodia of the anterior segments lack intermediate pre-setal lobes, giving a bi-lobed, not tri-lobed structure.

Perinereis cultrifera (Grube, 1840)

(Fig. 7. A)

Perinereis cultrifera: Fauvel, 1923 : 352, fig. 137. a-l; 1953 : 206, fig. 106. a-l; Day, 1967 : 337, fig. 14.13. o-q.

HABITAT. Chiefly under coral boulders on sand at MTL; also in crevices in reef platform and in beachrock.

RECORDS. Kokomtambu Is. – 1; Tetel Is. – 3; Matiu Is. – 6; New Manra – 32; Maraunibina Is. – 4; Lauvie Is. – 1; Graham Pt. – 4; Yandina – 1; Fanalei – 2 (heteronereids).

NOTES. Two female heteronereid stages of this species are included in the collection made during the 'palolo' rising at Fanalei on 2.xi.66 (local name – 'falisi ogu'). They were taken between 2000 and 2200 hours and correspond to the description of this stage given by Izuka (1912) and Fauvel (1923) except that lower ligule of the notopodium in the modified parapodium has a small ear-shaped lobe arising from its ventral margin (fig. 7. A). These specimens measure 45 and 52 mm long for 116 and 225 segments respectively, with the modified parapodia commencing at setigers 20 to 22.

DISTRIBUTION. Cosmopolitan.

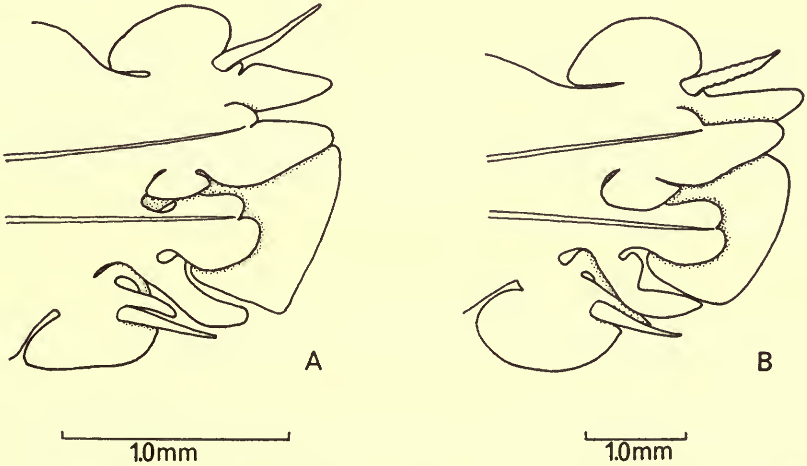

FIG. 7. *Perinereis cultrifera* (A) Modified parapodium of heteronereid (♀) stage (setae omitted). *Perinereis nuntia* (B) Modified parapodium of heteronereid (♂) stage (setae omitted).

Perinereis nigropunctata (Horst, 1889)

Nereis (*Perinereis*) *nigro-punctata* Horst 1889 : 171, pl. 8, figs 1–3; 1924 : 171.
Perinereis nigro-punctata: Fauvel, 1953 : 210, fig. 107. b-f; Day, 1967 : 337, fig. 14.13. r-v.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes; under coral boulders; abundant in beachrock.

RECORDS. Batuona Is. – 2; Graham Pt. – 2; Lauvie Is. – num.

DISTRIBUTION. Tropical Indo-west-Pacific.

Perinereis nuntia (Savigny, 1818)

(Fig. 7. B)

Perinereis nuntia: Fauvel, 1953 : 212, fig. 109. a-g; Day, 1967 : 334, fig. 14.12. p-s.

HABITAT. Chiefly found under boulders lying on clean sand and gravel at MTL.

RECORDS. Haroro – 3; Tetel Is. – 3; Cape Esperance – 17; Matiu Is. – 2; New Manra – 3; Mouth of Lunga R. – 4; Yandina – 50; Honiara – 20; Vera Vera Entrance – 1 (heronereid (♂)).

NOTES. In these specimens there are 1 to 3 paragnaths in group I and the paragnaths of group VI are usually flattened, sometimes mixed with conical forms. However the number of paragnaths in group V is very variable: for example, in the sample of 50 individuals from the Yandina population, one specimen has four paragnaths in group V, 26 have three arranged in a triangle, 11 have two and 12 have only one. Thus in terms of the subspecific forms (see Fauvel, 1953) *Perinereis nuntia brevicirrus* composes about half the population and *P. nuntia vallata* about a quarter, the remaining quarter being intermediate in character between these two forms.

The male heteronereid stage of *P. nuntia brevicirrus* was captured swimming near the surface at Vera Vera Entrance on 8.xi.65 at 1500 hours. It measures 90 mm long for about 150 segments, the modification of the parapodia starting between setigers 23 to 27. The structural details of the modified parapodium (fig. 7. B) follow those described and figured by Izuka (1912, as *N. mictodonta*).

DISTRIBUTION. South Africa; Indo-Pacific.

Platynereis insolita Gravier, 1901

Platynereis insolita Gravier 1901 : 197, pl. 12, fig. 53, text-figs 203–206; Day, 1967 : 307, fig. 14.4.1.

HABITAT. Under coral boulder; amongst *Phyllochaetopterus socialis* tubes and *Amphiroa* growth.

RECORDS. Matiu Is. – 1; Komimbo Bay – 1; New Manra – 2.

DISTRIBUTION. Indian Ocean.

Pseudonereis anomala Gravier, 1901

Pseudonereis anomala Gravier, 1901 : 191, pl. 12, figs 50–52, text-figs 194–202; Fauvel, 1953 : 217, fig. 110. e-g; Day, 1967 : 333, fig. 14.12. g-j.

Habitat. Abundant amongst *Phyllochaetopterus socialis* tubes and *Amphiroa*; burrowing in reef platform and beachrock.

Records. Mamara Pt. – 1; Batuona Is. – num.; New Manra – num.; Yandina – 6; Maramasike Pg. – 3.

Distribution. Indo-Pacific.

Pseudonereis masalacensis (Grube, 1878)

Nereis (*Lycoris*) *masalacensis* Grube, 1878 : 75, pl. 5, fig. 4.
Pseudonereis masalacensis: Fauvel, 1947 : 51, fig. 49. a-k.

Habitat. Under coral boulders on sand at MTL; amongst *Phyllochaetopterus socialis* tubes and algal growth (*Amphiroa*).

Records. Batuona Is. – 2; New Manra – 3; Yandina – 2.

Distribution. West and South Pacific.

Pseudonereis variegata (Grube, 1857)

Pseudonereis gallapagensis: Fauvel, 1953 : 215, fig. 110. a-c.
Pseudonereis variegata: Day, 1967 : 331, fig. 14.12. a-f.

Habitat. Burrowing in reef platform and beachrock; amongst *Amphiroa*; under boulders on clean sand.

Records. Matiu Is. – 8; Sifola – 8; New Manra – 2; Lauvie Is. – 3; Yandina – 2.

Distribution. Circumtropical.

Solomononereis n. gen.

Prostomium with two antennae, two biarticulate palps and two pairs of eyes. Peristomium with four pairs of tentacular cirri, dorsal pairs long, ventral pairs much shorter. Proboscis with small, rod-like chitinous paragnaths arranged in eight discrete groups on the maxillary ring; oral ring without paragnaths. Parapodia biramous with spinigerous setae in both rami throughout the body; falcigerous setae in both rami in the middle and posterior segments.

Type species. *Solomononereis marauensis* Gibbs

Solomononereis marauensis n. gen. n. sp.

(Fig. 8. A–H)

DESCRIPTION. The holotype measures 45 mm for 123 segments and is incomplete posteriorly. The largest of the three paratypes is 40 mm for 157 segments. The width of the body is about 3 mm.

The prostomium is rectangular in shape with two short, widely spaced antennae, two pairs of eyes, and a pair of palps with stout palpophores, often with a constriction just below the tip, and small palpostyles (fig. 8. A). The peristomium is weakly developed and is present as a narrow band on the dorsal surface but does not form a distinct ring ventrally. Of the four pairs of tentacular cirri, the two dorsal pairs are very long, extending back as far as setiger 20 but the ventral pairs are short, reaching to setiger 3 only.

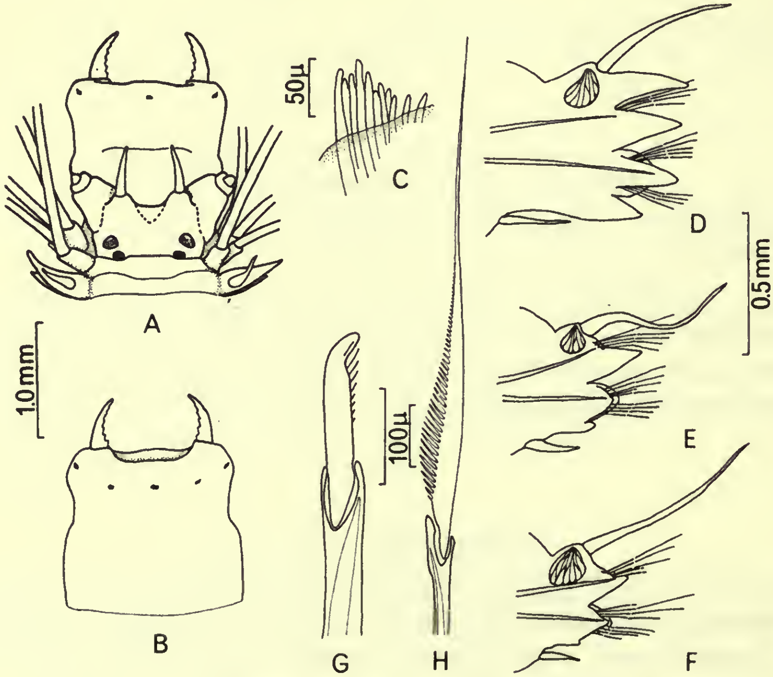

FIG. 8. *Solomononereis marauensis* n.gen., n.sp. (A) Dorsal view of anterior region and proboscis. (B) Ventral view of proboscis. (C) Paragnaths of Group II. (D–F) Anterior, middle and posterior parapodia. (G) Notopodial falciger. (H) Subacicular neuropodial spiniger.

The proboscis carries a pair of brown, curved jaws, each with 7 or 8 teeth. The chitinous paragnaths are confined to the maxillary ring; they are minute, rod-like (7–10μ in diameter) structures which are closely packed together in eight groups, three on the dorsal side and five on the ventral (fig. 8. A, B). Each of these discrete groups is composed of 10 to 15 paragnaths (fig. 8. C).

The structure of the parapodia changes progressively throughout the body and those of the anterior region are larger than those of the middle and posterior parts of the body. In the anterior region, the notopodium has two pointed ligules and the neuropodium has a bilobed upper ligule, composed of a pointed pre-setal lip and a rounded post-setal lip, and a pointed lower ligule (fig. 8. D). Between setigers 20 and 30, the upper notopodial ligule and the lower neuropodial ligule decrease in size, the former being lost altogether in more posterior segments while the latter persists as a rudiment (fig. 8. E, F). The dorsal cirri are slightly longer than the parapodial lobes in anterior segments but are relatively much longer in the posterior segments because of the diminished size of the parapodia.

At the base of the dorsal cirri, there are conspicuous glands which are roughly oval in shape and have a yellowish colour in preserved (alcohol) specimens. Each gland consists of fascicles of spindle-shaped cells which appear to open to the exterior at a pore situated just above the base of the dorsal cirrus.

Spinigerous setae are present in both notopodial and neuropodial bundles throughout the body. The notosetae are all homogomphic while the neurosetae vary from homogomphic to hemigomphic in the superior position, becoming heterogomphic in the inferior part. Superior sub-acicular spinigers have coarsely serrated blades (fig. 8. H) but all others are finely serrated. In the region of setiger 40, and persisting to the posterior end, two or three homogomph falcigers (fig. 8. G) appear in the notopodial bundle and, in addition, a single heterogomph falciger appears in the supra-acicular part of the neuropodium. Each falciger has an elongate, ciliated blade with a curved tip supported by a distinct tendon. All setae have a crystalline appearance.

A dark brown pigment remains over the dorsal surface of the proboscis, prostomium and anterior segments in preserved specimens.

Solomononereis resembles *Ceratonereis* in having paragnaths only on the maxillary ring of the proboscis but this similarity is superficial, the shape, as well as the arrangement, of the 'toothpick' or rod-shaped paragnaths possessed by *Solomononereis* being very different to that of the conical paragnaths found in *Ceratonereis*. Other features separating *Solomononereis* from other nereid genera include the weakly developed peristomial ring and the arrangement of the setae, i.e. spinigers are present in both rami throughout the body and, in addition, a few falcigers appear in both rami of the middle and posterior parapodia.

HABITAT. In sticky mud above MTL close to freshwater outflows.

RECORDS. Fintry Pt. – 1 (holotype); Nggela Is. (Sandfly Passage) – 3.
British Museum (Natural History) Registration No. Holotype 1970·32
Paratypes 1970·33

Family NEPHTYIDAE

Nephtys (Aglaophamus) munamaorii n. sp.

(Fig. 9. A–B)

Description: The holotype (from ML 37) is the largest specimen in the collection. It measures 16 mm in length for 60 segments and is about 1 mm wide.

The prostomium is rectangular in shape, its length being about 1·5 times the width, and has four small antennae on the antero-lateral margins. The proboscis has a long median papilla on its dorsal side with 14 rather indistinctly aligned rows of 5 or 6 papillae. Two small eyes, which appear as black spots, are situated near the posterior border of the second segment.

Branchiae commence on setiger 3 and are well developed in the anterior half of the body but gradually diminish in size in the posterior half so as to be absent from the last 10 or 12 segments. Each branchia is involute with a dorsal cirrus at its base (fig. 9. A).

The setigerous lobes of the parapodial rami are pointed. In the anterior segments, both the pre-setal and the post-setal lamellae are rounded, the latter being slightly larger, but in posterior segments these lamellae are much reduced in size (fig. 9. B). There are no superior neuropodial lamellae.

Setae are of the three usual types. Barred (or laddered) capillary setae compose the anterior fan which also includes a few smooth capillaries: in posterior segments the barred setae are longer and more slender with less distinct bars. Smooth or minutely serrated capillaries form the posterior fan: in the latter, there is also a row of lyriform forked setae.

Four species belonging to the subgenus *Aglaophamus* have been described from the tropical Indo-west-Pacific region. These are *N.* (*A.*) *dibranchis* Grube, *N.* (*A.*)

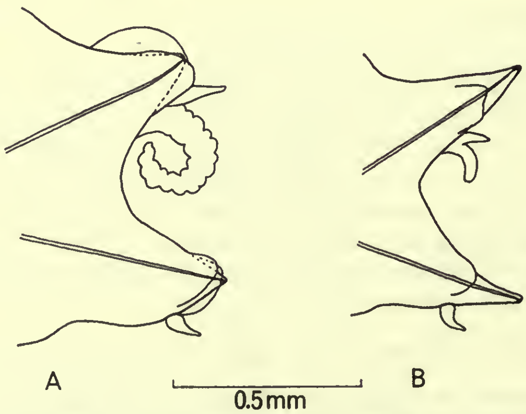

Fig. 9. *Nephtys* (*Aglaophamus*) *munamaorii* n.sp. (A–B) Anterior views of parapodia from setigers 19 and 45 respectively (setae omitted).

lyrochaeta Fauvel, *N.* (*A.*) *mirasetis* Hoagland, and *N.* (*A.*) *sinensis* Fauvel. In all four species the neuropodia of anterior segments have superior lamellae. The absence of this lamella, in addition to further differences in the parapodial structure, particularly the shape of the pre- and post-setal lamellae, is sufficient to distinguish *N.* (*A.*) *munamaorii*.

HABITAT. Mud and silty sand, 2–22 m depth.

RECORDS. ML 37 – 2 (including holotype); ML 69 – 1; ML 157 – 1; ML 188 – 8; ML 194 – 2; ML 196 – 1; ML 218 – 2.

British Museum (Natural History) Registration No. Holotype 1970·34
Paratypes 1970·35–41

Nephtys (Micronephthys) sphaerocirrata Wesenberg-Lund, 1949

Nephthys sphaerocirrata Wesenberg-Lund, 1949 : 294, figs 24-26.
Nephtys (*Micronephthys*) *sphaerocirrata*: Day, 1967 : 347, fig. 15.3. a-d.

HABITAT. Silty sand at 15 m depth.

RECORD. ML 116 – 1.

NOTES. The single specimen is an anterior fragment of 33 segments, 5 mm in length. It differs from the type specimen in having two pairs of reddish eyes situated near the posterior margin of the prostomium. These may represent a sexual character since the specimen is a mature female containing oocytes. Other details agree with the type description.

DISTRIBUTION. Persian Gulf; South Africa; Marshall Islands.

Nephtys (Nephtys) sp. cf. ***palatii*** Gravier, 1904

Nephthys palatii Gravier, 1904 : 472; 1906 : 129, pl. 1, figs 163–164, text-figs 286–289.

HABITAT. A wide variety of deposits from mud to coarse sand, 2–18 m depth.

RECORDS. ML 39 – 1; ML 68 – 1; ML 97 – 1; ML 156– 1; ML 191 – 1; ML 192 – 1; ML 196 – 1; ML 203 – 1; ML 229 – 2.

NOTE. These specimens are close to *N. palatii* but the identity is uncertain because, on dissection, a median dorsal papilla could not be seen on the proboscis.

Family **LACYDONIIDAE**

Paralacydonia weberi Horst, 1923

Paralacydonia weberi Horst, 1923 : 221, figs 1–2; Fauvel, 1953 : 129, figs 65. e-f.

HABITAT. Mud and sand, 2–24 m depth.

RECORDS. ML 29 – 1; ML 190 – 1; ML 191 – 1; ML 230 – 1.

NOTE. The largest of the specimens is 10 mm long for 50 segments and is much smaller than the holotype (40 mm for 100 segments) which was dredged from deep water (959 m).

DISTRIBUTION. Burma; East Indies; Samoa; Bass Strait.

Family **GLYCERIDAE**

Subfamily **GLYCERINAE**

Glycera gigantea Quatrefages, 1865

Glycera gigantea: Fauvel, 1923 : 387, fig. 152. d-k; 1953 : 296, fig. 152. d-k; Day, 1967 : 362, fig. 16.2. l-n.

HABITAT. A wide variety of deposits, chiefly silty mud and sand, from above MTL to 33 m depth.

RECORDS. Tetel Is. – 1; Florida Is. – 3; Komimbo Bay – 7; New Manra – 1; Graham Pt. – 8; Fintry Pt. – 4; Maraunibina Is. – 1; ML 229 – 1. (ML stations 100, 110, 192, 195 – one juvenile (?) at each).

DISTRIBUTION. North Atlantic; Mediterranean; Laccadive Sea; New Britain; N.E. Australia; Japan; eastern North Pacific.

Glycera lancadivae Schmarda, 1861

Glycera lancadivae Schmarda, 1861 : 95, with text-figs; Fauvel, 1953 : 291, fig. 147. g-h; Day, 1967 : 359.

HABITAT. A wide variety of deposits, from fine coral mud to coarse sand and shell gravel from above MTL to 11 m depth.

RECORDS. Tetel Is. – 3; Komimbo Bay – 4; Naro Bay – 1; Matiu Is. – 11; Maraunibina Is. – 22; Graham Pt. – 8; Fintry Pt. – 9; Yandina – 4; ML 98 – 1; ML 203 – 1; ML 229 – 2.

DISTRIBUTION. Tropical Indian Ocean; N.E. Australia; New Caledonia.

Glycera longipinnis Grube, 1878

Glycera longipinnis Grube, 1878 : 182, pl. 8, fig. 9; Fauvel, 1932 : 125, pl. 4, figs 11–14; 1953 : 291, fig. 148. a-d; Day, 1967 : 356, fig. 16.1. a-f.

HABITAT. Muddy silt (*Thalassia* flat) at LWM.

RECORD. Komimbo Bay – 1.

DISTRIBUTION. Tropical Indo-west-Pacific.

Glycera rouxi Audouin & Milne-Edwards, 1833

Glycera rouxi: Fauvel, 1923 : 389, fig. 153. a-c; 1953 : 297, fig. 149. a-d; Day, 1967 : 362, fig. 16.3. a-d.

HABITAT. Silty mud at 9 m depth.

RECORD. ML 38 – 1.

DISTRIBUTION. North Atlantic; Mediterranean; Indo-west-Pacific to Japan; California.

Family **EUNICIDAE**

Subfamily **EUNICINAE**

Eunice afra Peters, 1854

Eunice afra: Crossland, 1904 : 289, pl. 20, fig. 1–5, text-figs 43–45; Fauvel, 1953 : 235, fig. 116. h-i; Day, 1967 : 392, fig. 17.5. a-e.

HABITAT. Boring in coral on reef platform and in beachrock; amongst *Phyllochaetopterus socialis* tubes at LWM.

RECORDS. Matiu Is. – 4; Mamara Pt. – 2; Batuona Is. – 2; New Manra – 1; Lauvie Is. – 2; Lingatu – 4; Yandina – 1; Maramasike Pg. – 5.

DISTRIBUTION. Indo-west-Pacific.

Eunice antennata (Savigny, 1820)

Eunice antennata: Crossland, 1904 : 312, pl. 22, figs 1–7, text-figs 56–60; Fauvel,1 953 : 240, fig. 118. f-g; Day, 1967 : 384, fig. 17.2. k-q.

HABITAT. Boring in coral and under coral boulders on reef platform.

RECORDS. Matiu Is. – 5; Graham Pt. – 2; Yandina – 1.

DISTRIBUTION. North Atlantic; tropical Indo-Pacific.

Eunice aphroditois (Pallas, 1788)

Eunice aphroditois: Fauvel, 1953 : 233, fig. 117. a-g; Day, 1967 : 389, fig. 17.4. l-o.

HABITAT. In *Acropora* rubble and under coral boulder on reef platform at LWM.

RECORDS. Tetel Is. – 1; Maraunibina Is. – 2.

DISTRIBUTION. North Atlantic; Mediterranean; Indo-Pacific to Japan and southern California.

Eunice coccinea Grube, 1878

Eunice coccinea Grube, 1878 : 153, pl. 9, fig. 1; Crossland, 1904 : 297, pl. 20, figs 6–7, text-figs 46–51; Fauvel, 1953 : 236, fig. 118. a-e; Day, 1967 : 389.

Habitat. Boring in coral on reef platform.

Records. Komimbo Bay – 1; Mamara Pt. – 1; New Manra – 1; Lingatu – 1; Maramasike Pg. – 2; Fanalei – 2 (posterior fragments).

Notes. The two posterior fragments in the collection from the Fanalei 'palolo' rising (2–3.ix.66) can be identified by their relative size, absence of gills, parapodial structure and setae. One is female and contains large spherical oocytes (360μ in diameter). On one side of each of these oocytes there is a patch of dark green pigment, surrounding a clear circular spot. The time of spawning is recorded as midnight to 0600 hours. The local name is 'raka-raka'.

Distribution. Gulf of Guinea; tropical Indo-west-Pacific.

Eunice grubei Gravier, 1900

Eunice grubei Gravier, 1900 : 258, pl. 14, figs. 87-88, text-figs 125–129; Fauvel, 1953 : 237, fig. 119. a-e; Day, 1967 : 391.

Habitat. Sedimented crevices in *Porites* boulders.

Records. Graham Pt. – 2.

Notes. One specimen is complete and, in this, the branchiae, which are present only on the anterior half of the body, have a maximum of 4 or 5 filaments.

Distribution. Tropical Indo-west-Pacific.

Eunice marovoi n. sp.

(Fig. 10. A–H)

Eunice sp.: Gibbs, 1969 : 455, fig. 133.

Description. Complete specimens from the dredged material have a maximum length of 15 mm for 60 to 70 segments and a width of 1·0 to 1·5 mm. Larger specimens discovered living on *Cerithium vertagus* are all incomplete but are estimated to have been 20 to 25 mm in length. The holotype from ML 96 is 15 mm long for 66 segments.

The prostomium is bilobed with a shallow median groove between the palps (fig. 10. A). The antennae are weakly annulated and the median is about twice as long as the laterals, which, in turn, are about equal in length to the tentacular cirri (fig. 10. B). The eyes are black and reniform in shape.

The mandibles are elongate calcified plates. The maxillae are almost transparent but the toothed edges are brownish in colour and the medial and anterior edges of the maxillae supports ("carriers") are black, forming a T-shaped figure (fig. 10. C). Due to the transparent nature of the maxillae the details are difficult to determine. Maxillae I are falcate and devoid of basal teeth. The left Maxilla II is falcate with 4 to 6 ill-defined basal teeth. The right Maxilla II, left Maxilla III and Maxillae IV all have 10 to 13 small teeth while Maxillae V are toothless plates. The maxillary formula thus reads: Mx. I = 1 + 1; Mx. II = (1 + (4 — 6)) + (10 — 13); Mx. III = (10 — 13) + 0; Mx. IV = (10 — 13) + (10 — 13).

Branchiae commence on setiger 3 on all specimens and these are strongly arched over the dorsum, with a maximum of 5 or 6 filaments (fig. 10. D). In the larger specimens there are 21 to 23 pairs (i.e. extending to setigers 23 to 25) but smaller

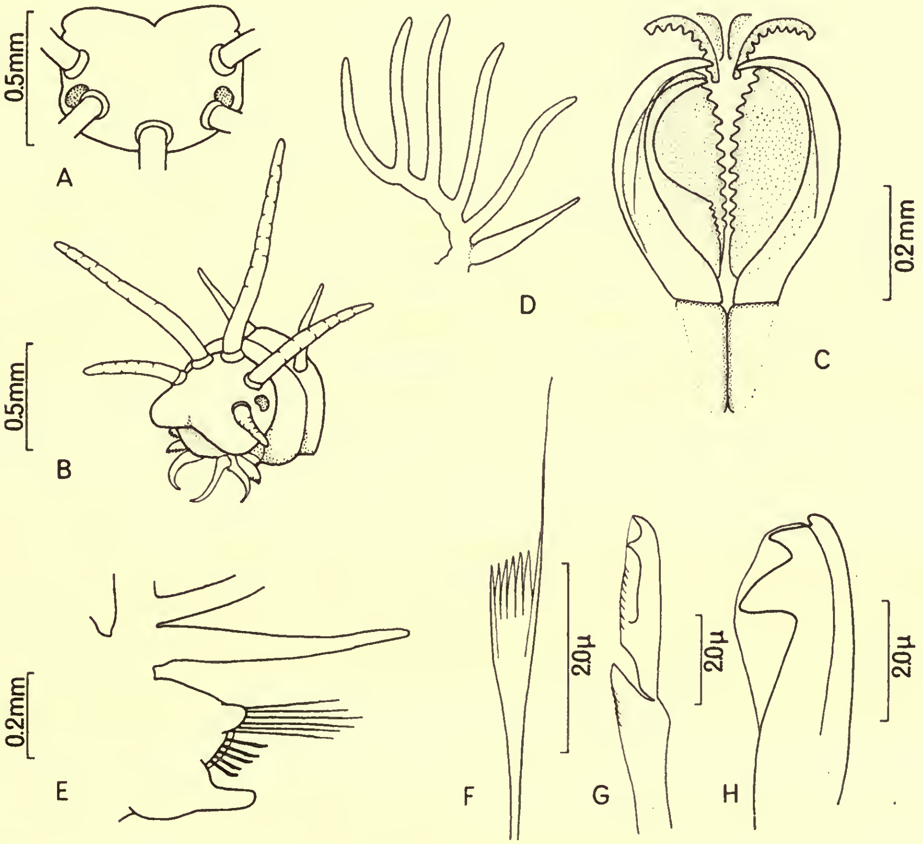

FIG. 10. *Eunice marovoi* n.sp. (A) Dorsal view of prostomium. (B) Antero-lateral view of anterior region. (C) Jaws. (D–E) Branchia and parapodium of setiger 10. (F) Comb seta. (G) Falciger. (H) Acicular seta.

specimens have only 15 to 20 pairs. The dorsal cirri are shorter but slightly stouter than the branchial filaments. On branchiferous segments, the ventral cirri are short and are swollen at their bases (fig. 10. E), a feature that is absent in the more posterior segments.

Acicula and setae are transparent. The capillary setae are slender with finely serrated edges. Comb setae are few in number and have about 7 teeth, one of the outer pair being greatly elongated (fig. 10. F). The falcigerous setae have bidentate blades with faintly serrated guards (fig. 10. G). Acicular setae are tridentate with rounded guards (fig. 10. H); two or three occur in each parapodium from setigers 15 to 20 to the posterior end. The projecting tips of the acicula are rounded and slightly curved.

The colour of preserved specimens is white. Despite their small size, a number of the specimens are mature with coelomic gametes. It would appear therefore that *E. marovoi* does not exceed 20 to 25 mm in length even when fully grown.

E. marovoi is distinct from all other *Eunice* species known from the Indo-west-Pacific region in terms of its maxillary structure, the number of branchiae and branchial filaments, in combination with the structure of the setae.

HABITAT. A wide variety of deposits ranging from mud to coarse sand from LWM to 33 m depth. At LWM on a sand flat to the north of Tankomo Is. (in the southern part of Marovo Lagoon) *E. marovoi* was discovered attached to the shell of the gastropod *Cerithium vertagus* L.

RECORDS. ML 37 – 1; ML 96 – 1 (holotype); ML 97 – 1; ML 100 – 1; ML 110 – 9; ML 134 – 1; ML 192 – 2; ML 218 – 1; ML 229 – 1; ML 230 – 2; north of Tankomo Is. – 5.

British Museum (Natural History) Registration No. Holotype 1970·42
Paratypes 1970·43–52

NOTES. The tube of this species is constructed of coarse bottom material, such as scaphopod and bivalve shell fragments, cemented to an organic lining. In those specimens associated with *Cerithium vertagus*, the tube was constructed along the length of the upper surface of the gastropod shell (see Gibbs, 1969).

Eunice norvegica (Linnaeus, 1767)

Eunice floridana: Fauvel, 1923 : 402, fig. 157. a-g; 1953 : 235, fig. 117. a-g.
Eunice norvegica: Pettibone, 1963 : 240, fig. 63. f; Day, 1967 : 388, fig. 17.3. r-v.

HABITAT. On surface of *Acropora* sp.

RECORD. Yandina – 1.

NOTES. The specimen is 17 mm long, 3 mm wide and has 70 segments (apparently regenerating from setiger 27). Its preserved colour is medium brown with three whitish spots per segment arranged in longitudinal lines down the body; the gills and dorsal cirri are purple. In life the colour was bluish-black with orange spots. The maxillary formula is: Mx. I = 1 + 1; Mx. II = 7 + 7; Mx. III = 6 + 0; Mx. IV = 4 + 8; Mx. V = 1 + 1. The labrum is calcified and pearly-white in colour. The branchiae start on setiger 5 and have a maximum of 6 or 7 filaments. Acicular setae are black with conspicuous guards.

In specimens from other localities the branchiae commence between setigers 7 to 10 but otherwise this specimen agrees in detail. Apart from a single specimen from Indo-China (Fauvel, 1939) no other records of *E. norvegica* from the Pacific Ocean have been traced despite the species being widespread and occurring in depths of over 1500 m (Pettibone, 1963).

DISTRIBUTION. North Atlantic; Mediterranean; Indian Ocean; Indo-China.

Eunice tentaculata Quatrefages, 1865

Eunice tentaculata: Fauvel, 1953: 234, fig. 118. m-p; Day, 1967 : 391, fig. 17.4. s-v.

HABITAT. Under coral boulders on silty sand; amongst *Phyllochaetopterus socialis* tubes.

RECORDS. Maraunibina Is. – 2; Batuona Is. – 1.

DISTRIBUTION. Indo-west-Pacific.

Eunice tubifex Crossland, 1904

Eunice tubifex Crossland, 1904 : 303, pl. 21, figs 1–8, text-figs 52–55; Fauvel, 1953 : 232, fig. 116. a-g; Day, 1967 : 386, fig. 17.3. k-q.

HABITAT. In coral at LWM and on wharf piles at 5 m depth.

RECORDS. Tetel Is. – 2; Yandina – 2.

DISTRIBUTION. Tropical Indo-west-Pacific.

Eunice (Palola) siciliensis Grube, 1840

Eunice (*Palola*) *siciliensis*: Fauvel, 1923 : 405, fig. 159. e-m; 1953 : 241, fig. 121. e-m; Day, 1967 : 382, fig. 17.2. a-f.

HABITAT. Boring in coral and beachrock; in *Acropora* rubble and shell gravel; under coral boulders in silty sand.

RECORDS. Kokomtambu Is. – 1; Tetel Is. – 16; Komimbo Bay – 2; Mamara Pt. – 3; Matiu Is. – 34; Yandina – 2; Lingatu – 6; New Manra – 9; Lauvie Is. – 11; Graham Pt. – 4; Maramasike Pg. – 10; Fanalei – 4 (posterior fragments).

NOTES. The four posterior fragments collected during the spawning at Fanalei can be readily identified by the absence of comb and acicular setae, the black acicula and the dark spot on the ventral surface of each segment. Three of the fragments are female and contain spherical oocytes about 200μ in diameter. The time of spawning on 2.xi.66 was between 2000 and 2200 hours. The local name is "falisi ogu".

DISTRIBUTION. Mediterranean; circumtropical.

Lysidice collaris Grube, 1870

Lysidice collaris: Fauvel, 1953 : 248, fig. 124. a-g; Day, 1967 : 402, fig. 17.8. a-f.

HABITAT. Boring in coral and beachrock; amongst *Phyllochaetopterus socialis* tubes; in the sponge *Halichondria* sp. at 5 m depth.

RECORDS. Matiu Is. – 5; Batuona Is. – 1; New Manra – 3; Sifola – 2; Lingatu – 2; Mamara Pt. – 2; Graham Pt. – 1; Lauvie Is. – 1; Yandina – 12; Fanalei – 1.

NOTES. The specimen from the Fanalei "palolo" rising is spent. It has enlarged eyes provided with lenses.

DISTRIBUTION. Tropical Indo-Pacific to Japan and Gambier Islands.

Marphysa macintoshi Crossland, 1903

Marphysa macintoshi Crossland, 1903 : 137, pl. 14, figs 3–6, text-fig. 12; Fauvel, 1953 : 246; Day, 1967 : 396, fig. 17.6. a-e.

HABITAT. Silty mud at MTL.

RECORDS. Nggela Is. – 3.

DISTRIBUTION. Tropical Indian Ocean.

Nematonereis unicornis (Grube, 1840)

Nematonereis unicornis: Fauvel, 1923 : 412, fig. 162. h-n; 1953, 249, fig. 124. h-n; Day, 1967 : 403, fig. 17.8. j-n.

HABITAT. Under boulders in muddy silt at MTL; amongst *Phyllochaetopterus socialis* tubes at LWM.

RECORDS. Tetel Is. – 1; Batuona Is. – 1.

DISTRIBUTION. North Atlantic; Mediterranean; tropical Indo-west-Pacific.

Subfamily ONUPHINAE

Onuphis (Nothria) holobranchiata Marenzeller, 1879

Onuphis (Nothria) holobranchiata Marenzeller, 1879 : 132, pl. 4, fig. 1; Izuka, 1912 : 106, pl. 11, figs 10–12; Fauvel, 1953 : 256, fig. 127. f-h; Day, 1967 : 424, fig. 17.13. f-g.

HABITAT. A wide variety of deposits, from silty sand to coarse sand and shell gravel from MTL to LWM; mud with organic debris at 2 m depth.

RECORDS. Tetel Is. – 14; Komimbo Bay – 1; Matiu Is. – 1; Kalota Is. – 1; ML 68 – 37.

NOTES. The distribution of the simple branchiae over the anterior segments shows some degree of variation, perhaps reflecting differences in the growth stages. For example, in the smaller specimens present in the large sample obtained at ML 68 the branchiae commence on setigers 2 to 5 whereas in the larger specimens from the same sample they begin on the first setiger, as typical for the species. Specimens of all sizes possess similar pseudocompound hooks.

The dredged specimens were chiefly extracted from tubes composed of plant debris and sediment particles cemented to an organic lining and often the tubes were found to run along the central cavities of hollow plant stems. Specimens from the littoral zone had tubes encrusted with coarse sand grains and *Halimeda* discs.

DISTRIBUTION. Tropical Indo-west-Pacific to Japan.

Subfamily LYSARETINAE

Oenone fulgida (Savigny, 1818)

Aglaurides fulgida: Fauvel, 1953, 250, fig. 125. a-f.

Oenone fulgida: Crossland, 1924 : 85, fig. 106–111; Imajima & Hartman, 1964 : 267; Day, 1967 : 426, fig. 17.14. a-g.

HABITAT. Boring in coral (*Porites*).

RECORDS. Tetel Is. – 2; Yandina – 1.

DISTRIBUTION. Circumtropical.

Subfamily LUMBRINERINAE

Lumbrineris latreilli Audouin & Milne-Edwards, 1834

Lumbriconereis latreilli: Fauvel, 1923 : 431, fig. 171. m-r; 1953 : 266, fig. 134. m-r.

Lumbrineris latreilli: Day, 1967 : 438, fig. 17.16. p-t.

HABITAT. Under coral boulders in silty sand; mud at 18 m depth.

RECORDS. Tetel Is. – 1; Komimbo Bay – 1; Graham Pt. – 2; Maraunibina Is. – 1; ML 188 – 1.

DISTRIBUTION. Cosmopolitan.

Lumbrineris papillifera (Fauvel, 1919)

Lumbriconereis papillifera Fauvel, 1919a : 395, pl. 15, figs 9–16.
Lumbrineris papillifera: Day, 1967 : 442, fig. 17.17. p-s.

HABITAT. Silty sand at 9 m depth.

RECORD. ML 56 – 1.

NOTES. The specimen is incomplete posteriorly but middle segments having the characteristic ventral papillae are present and other details correspond to the species description. This is the first record of the species from the Pacific region.

DISTRIBUTION. Tropical East Africa.

Lumbrineris sphaerocephala (Schmarda, 1861)

Notocirrus sphaerocephalus Schmarda, 1861 : 116, with text-figs.
Lumbriconereis sphaerocephala: Ehlers, 1904 : 33, pl. 5, figs 3–11; Fauvel, 1953 : 267, fig. 135. c-f.

HABITAT. Clean sand at LWM.

RECORD. Komimbo Bay – 1.

DISTRIBUTION. Indo-west-Pacific.

Subfamily **ARABELLINAE**

Arabella iricolor (Montagu, 1804)

Arabella iricolor: Fauvel, 1923 : 438, fig. 175. a-h; 1953 : 274, fig. 140. a-h; Day, 1967 : 446, fig. 17.18. i-m.

HABITAT. Under boulders in muddy silt, sand and shell gravel at MTL.

RECORDS. Tetel Is. – 3; Maraunibina Is. – 2; Graham Pt. – 6.

DISTRIBUTION. Cosmopolitan.

Arabella mutans (Chamberlin, 1919)

Arabella mutans: Fauvel, 1953 : 275, figs 140. i-l, 143. g-i; Day, 1967 : 446, fig. 17.18. f-h.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes at LWM.

RECORDS. Batuona Is. – 5.

DISTRIBUTION. North Atlantic; East Africa; Easter Is.; eastern Pacific.

Drilonereis major Crossland, 1924

Drilonereis major Crossland, 1924 : 57, figs 73–79; Fauvel, 1953 : 277, fig. 143. k-l.

Habitat. Boring (?) in coral on reef platform at LWM.

Records. Maramasike Passage – 2.

Notes. The prostomium is semi-circular and flattened. The maxillary formula is Mx. I = 1 + 1; Mx. II = 6 + 6; Mx. III = (3 — 4) + (3—4); Mx. IV = (2 — 3) + (2 — 3): the teeth of Mx. III and Mx. IV are very irregular in size and difficult to count, as noted by Fauvel (1932). This is a new record for the Pacific region.

Distribution. Gulf of Suez; Zanzibar; Bay of Bengal.

Subfamily **DORVEILLEINAE**

Dorvillea sp.

Habitat. Coarse sand at MTL.

Record. Komimbo Bay – 1.

Notes. The specimen is 7 mm long (incomplete). Its antennae have eight annuli and the dorsal cirri, commencing on setiger 2, are mounted on long cirrophores. Forked setae are present from the first setiger and have unequal prongs. It is close to *D. incertus* (Schmarda) but differs from this species in having forked setae from the first, not the second, setiger.

Family **ORBINIIDAE**

Haploscoloplos bifurcatus Hartman, 1957

Haploscoloplos bifurcatus Hartman, 1957 : 277.

Habitat. Mud and silty sand, 2–13 m depth.

Records. ML 68 – 16; ML 69 – 1; ML 228 – 2.

Notes. The thorax is composed of 17 to 20 setigers. Branchiae commence on setigers 8, 9 or 10 as small triangular lobes, increasing in size on the posterior thoracic segments. Characteristically, the post-setal lobes of the neuropodia in the posterior half of the thorax (from setiger 12) are divided. Abdominal parapodia lack interramal cirri.

Distribution. South and south-east Australia.

Naineris laevigata (Grube, 1855)

Naineris laevigata: Fauvel, 1927 : 22, fig. 7. a-l; 1953 : 310, fig. 163. a-l; Hartman, 1957 : 297, pl. 35, figs 1–8; Day, 1967 : 539, fig. 32.2. a-f.

HABITAT. Medium to coarse sand, MTL to LWM.

RECORDS. Haroro – 1; Graham Pt. – 2.

DISTRIBUTION. Cosmopolitan in warm waters.

Family **SPIONIDAE**

Dispio maroroi n. sp.

(Fig. 11. A–D)

DESCRIPTION. All four specimens are incomplete. The holotype is 18 mm in length with 46 segments and the largest of the paratypes is 45 mm long for 86 segments. The diameter of the body is about 2 mm.

The prostomium is pointed anteriorly and extends back as an occipital ridge to the first segment where it forms a small occipital tentacle (fig. 11. A). On either side of this ridge there are conspicuous nuchal slits which are concealed at their posterior ends by dorsal extensions of the peristomium. Two small eyes, not visible from the dorsal aspect, are situated laterally on the prostomium. The palps are missing on all specimens.

The parapodia of the first two segments differ from those of subsequent segments in that the post-setal lobes of the notopodia are expanded, with 6 or 7 digitiform processes along their free edges (fig. 11. B). The lobes of subsequent notopodia have smooth outlines. The post-setal neuropodial lobes of the first few segments are rounded, becoming flatter in shape in later segments. Pre-setal lobes are low and rounded.

Branchiae are present on all segments from setiger 1. They are fused with the post-setal notopodial lobes for most of their length and are slightly longer than the lobes. Commencing between setigers 18 to 20, accessory branchiae appear on the posterior side of the notopodia. Each is a palmate group of 6 to 8 lobes, each lobe containing a vascular loop (fig. 11. C).

Apart from the first setiger, which has a bundle of long fine capillaries which projects forward over the head region, the notosetae are broad-winged and narrow-winged capillaries, the two types being of similar length. The neurosetae of the anterior segments are similar to the notosetae except that the narrow-winged capillaries are longer than the broad-winged. Between setigers 24 to 28, the broad-winged capillaries are replaced by very finely pointed setae and 4 or 5 unidentate hooded hooks appear (fig. 11. D). In all neuropodia, there is an inferior group of 4 or 5 sabre-like setae.

D. maroroi is close to the type species *D. uncinata* Hartman (1951) from Florida but differs from it in that the post-setal notopodial lobes of setigers 1 and 2 are much enlarged whilst that of setiger 3 is unmodified. A further difference is that the accessory branchiae start between setigers 18 to 20 not between setigers 24 to 28 and also there are minor variations in the form of the head region. In other details the specimens from the Solomon Islands resemble those from Florida. The central American species *D. remanei* and *D. schusterae*, described by Friedrich (1956), both differ in having digitate neuropodial, as well as notopodial, lobes in the anterior segments. In the fourth species, *D. magna* (Day, 1955) the accessory branchiae take the form of minute lamellae, not lobes.

HABITAT. Clean sand at LWM.

RECORDS. Komimbo Bay – 1 (holotype); Graham Pt. – 3.

British Museum (Natural History) Registration No. Holotype 1970·53
Paratypes 1970·54

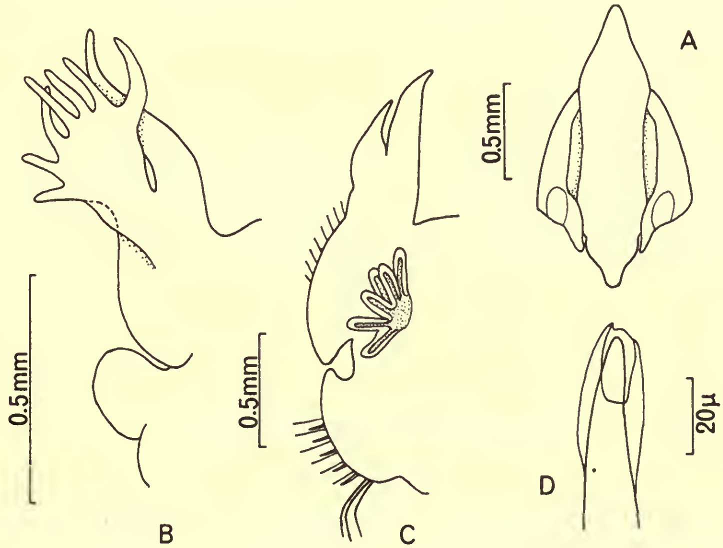

FIG. 11. *Dispio maroroi* n.sp. (A) Dorsal view of head region. (B–C) Posterior views of parapodia from setiger 1 (setae omitted) and setiger 40. (D) Neuropodial hook.

Laonice cirrata (Sars, 1851)

Laonice cirrata: Fauvel, 1927 : 38, fig. 12. a-e; 1953 : 315, fig. 165. a-e; Day, 1967 : 480, fig. 18.6. h-k.

HABITAT. Mud at 11 m depth.

RECORD. ML 195 – 1.

DISTRIBUTION. Cosmopolitan.

Malacoceros indicus (Fauvel, 1928)

Scolelepis indica Fauvel, 1928 : 93, fig. 2. g-m; 1953 : 313, fig. 165. g-m.
Malacoceros indicus: Pettibone, 1963a : 99 (synonymy); Day, 1967 : 477, fig. 18.5. p-u.

HABITAT. Silty mud and sand about MTL.

RECORDS. Nggela Is. – 2; Tetel Is. – 1; Fintry Pt. – 9.

NOTES. Specimens have 10 to 12 bidentate hooks in the neuropodia; in specimens from India there are less than 6.

DISTRIBUTION. Indo-west-Pacific.

Nerinides sp. cf. ***gilchristi*** Day, 1961

Nerinides gilchristi Day, 1961 : 491, fig. 5. a-d; 1967 : 485, fig. 18.7. i-l.

HABITAT. Silty sand (*Thalassia* flat).

RECORD. Komimbo Bay – 1.

NOTES. The specimen is in two parts – an anterior fragment of 15 setigers and a middle body section of 13 setigers. In the latter, the branchiae are flag-shaped, corresponding to those of *N. gilchristi*. However there are 7 or 8 hooded hooks per neuropodium, each with a single tooth above the main fang, not 10 to 12 hooks having three teeth above the main fang, as in *N. gilchristi*.

Polydorella novaegeorgiae n. sp.

(Fig. 12. A–F)

DESCRIPTION. All five specimens are incomplete. The largest fragment, chosen for the holotype, measures 15 mm for 50 setigers and has a width of 1·0 to 1·5 mm. The colour is whitish except for a brownish pigmentation on the peristomium and anterior segments.

The prostomium has a rounded anterior margin and extends back as a low ridge to the middle of setiger 2. On its dorsal surface there are two pairs of eyes and a small occipital papilla (fig. 12. A). The broad peristomium carries a pair of stout palps which reach to about setiger 15.

On the anterior segments, the notopodial lobes gradually increase in size and are largest on setiger 4. The neuropodial lobes of setigers 1 to 6 are similar in size and are semi-circular in outline; from setiger 7 they are small and inconspicuous. Branchiae commence on setiger 6 and continue to setigers 15 to 18 (i.e. there are 10 to 13 pairs). These are cirriform in shape, the longest being equal to the body width.

Both notosetae and neurosetae in the anterior segments, with the exception of the notosetae of setiger 4, are winged capillaries. The notopodial bundles are composed of two rows of curved capillaries which have narrow blades on one side (fig. 12. C), plus a superior group of similar form but much longer. The neurosetae are narrow-winged capillaries, each finely tapering to a sharp point.

As is characteristic of the genus, the notopodium of setiger 4 carries modified setae. Two types are present in a double row that follows a wide arc (fig. 12. B); those of the anterior row are strongly angled at their distal end with a broad blade showing fine striations (fig. 12. D) while those of the posterior row are stout hooks with bluntly tapering, slightly curved tips (fig. 12. E). There are between 20 and 25 pairs of the two types of modified setae, plus a superior group of about 15 narrow-winged capillaries, in each of the notopodia of setiger 4. In the post-branchial region the superior capillary group is replaced by a group of about 10 needle-like setae. Bidentate hooded hooks (fig. 12. F) commence at setiger 7 and number between 18 and 20 per neuropodium.

The type species *Polydorella prolifera* Augener was described from Sharks Bay, Western Australia, (Augener, 1914) and has been recorded from India (Gravely,

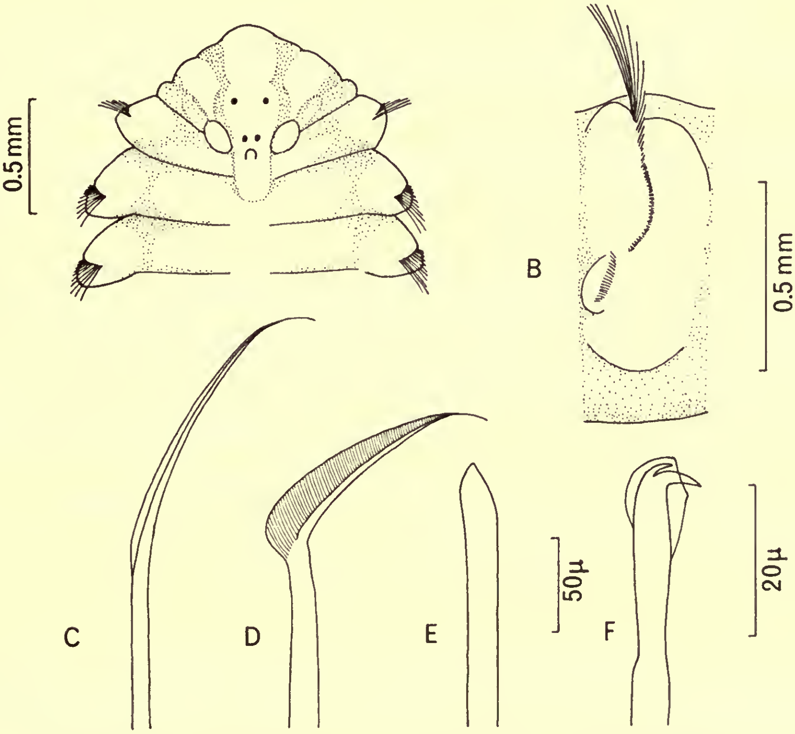

FIG. 12. *Polydorella novaegeorgiae* n.sp. (A) Dorsal view of anterior region. (B) Lateral view of setiger 4. (C) Notopodial capillary. (D–E) Modified notopodial setae from setiger 4. (F) Neuropodial hook.

1927; Fauvel, 1930). It differs from *P. novaegeorgiae* in many respects, particularly in the form of the prostomium, the structure of the modified setae of setiger 4 and in the number of branchiae. A further point of difference is that the specimens from Marovo Lagoon do not show any sign of reproduction by scissiparity, a feature observed in *P. prolifera.*

Habitat. Mud at 11 m depth.

Records. ML 39 – 5.

British Museum (Natural History) Registration No. Holotype 1970·55
Paratypes 1970·56

Prionospio cirrifera Wirén, 1883

Prionospio cirrifera: Fauvel, 1927 : 62, fig. 21. k-n; 1953 : 324, fig. 164. k-m; Day, 1967 : 486, fig. 18.8. a-d.

Habitat. Mud at 22 m depth.

Record. ML 29 – 1.

Notes. Although *P. cirrifera* has not been recorded previously from the west Pacific region the single specimen agrees in detail. It has 12 pairs of branchiae and the hooded crotchets are multidentate, corresponding to the northern form (cf. Day, 1967).

Distribution. North Atlantic; North Pacific; India; South Africa.

Prionospio ehlersi Fauvel, 1928

Prionospio ehlersi Fauvel, 1928a : 10, fig. 1. a-r; Day, 1967 : 490, fig. 18.9. d-f.

Habitat. Mud and sand, 2–22 m depth.

Records. ML 37 – 2; ML 41 – 4; ML 134 – 1; ML 156 – 8; ML 191 – 1; ML 194 – 2; ML 195 – 1; ML 218 – 6.

Note. This is the first record of *P. ehlersi* from the Pacific region.

Distribution. Morocco; East Africa.

Prionospio malmgreni Claparède, 1870

Prionospio malmgreni: Fauvel, 1927 : 61, fig. 21. a-e; Hartman & Imajima, 1964 : 285; Day, 1967 : 492, fig. 18.9. a-c.

Habitat. Silty sand at 2 m depth.

Records. ML 196 – 2.

NOTES. Both specimens are small, about 10 mm long. Across setiger 7 there is a membraneous ridge and this feature separates *P. malmgreni* from the closely allied species *P. steenstrupi* Malmgren.

DISTRIBUTION. Atlantic; Mediterranean; South Africa; South-west Australia; Japan; southern California.

Prionospio pinnata Ehlers, 1901

Prionospio pinnata: Fauvel, 1953 : 323, fig. 174. e; Imajima & Hartman, 1964 : 286; Day, 1967 : 488, fig. 18.8. i-l.

HABITAT. Mud and silty sand, 2–26 m depth

RECORDS. ML 37 – 10; ML 40 – 5; ML 41 – 27;. ML 110 – 4; ML 156 – 2; ML 157 – 2; ML 191 – 1; ML 194 – 2; ML 195 – 1.

DISTRIBUTION. Cosmopolitan.

Prionospio steenstrupi malayensis Caullery, 1914

Prionospio steenstrupi malayensis: Caullery, 1944 : 14, fig. 8. a-f.

HABITAT. A wide variety of deposits from mud to coarse sand, 2–24 m depth.

RECORDS. ML 55 – 2; ML 68 – 1; ML 188 – 1; ML 192 – 1; ML 196 – 5; ML 204 – 1; ML 230 – 1.

NOTES. Caullery recognized the subspecies *malayensis* on the grounds of geographical separation from the stem species which was then (1914) known only from the North Atlantic. In the Solomon Islands specimens there are low membraneous ridges across the dorsum from setiger 12 to setiger 16 or 17. These ridges are not present in the stem species and thus this feature distinguishes the two forms.

DISTRIBUTION. East Indies.

Prionospio tetelensis n. sp.

(Fig. 13. A–D)

DESCRIPTION. All specimens are incomplete. The holotype from ML 188 is 14 mm long for 42 segments and has a diameter of 2 to 3 mm. One of the paratypes (from ML 68) is a mature female containing oocytes which are turquoise blue in colour.

The prostomium is rounded anteriorly and extends back to setiger 3 as an elevated keel between peristomial folds (fig. 13. B). There are three pairs of prostomial eyes, two pairs of which are small and situated to the anterior of a larger, transverse pair. On either side of the prostomium, the peristomium is extended to form lateral wing-like expansions.

The first setiger is small and lacks notosetae. The parapodial lobes of the anterior segments are large and ear-shaped, the pre-setal ones being smaller than the post-setal (fig. 13. C). These lobes gradually decrease in size, becoming flatter and less rounded in the middle body. From setiger 6 to between setigers 20 to 26 the post-setal notopodial lobes are joined across the dorsum by membraneous ridges. In mature specimens there are no genital pockets between the anterior neuropodia.

Branchiae are present on setigers 2 to 5 and all are pinnate (fig. 13. A). Each has a short stem and numerous pinnules arising from the lateral and posterior surfaces of the main axis. The size of the branchiae decreases from the first to the fourth pair.

Both notosetae and neurosetae in the anterior segments are narrow-winged capillaries. Commencing between setigers 20 and 22, about 12 hooks appear in the neuropodia, accompanied by very fine pointed setae and also 2 or 3 sabre-like setae. Hooks do not appear in the notopodia until about setiger 50. Each hook is hooded with a series of five teeth above the main fang (fig. 13. D).

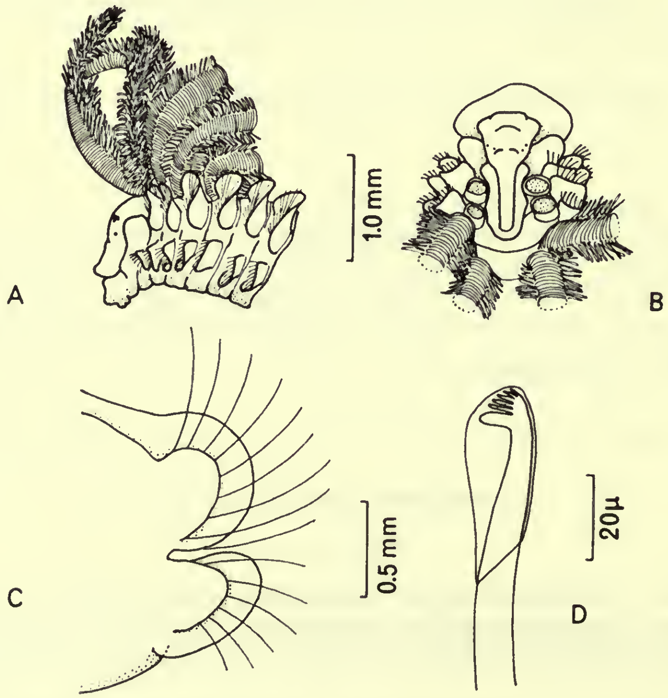

FIG. 13. *Prionospio tetelensis* n.sp. (A–B) Lateral and dorsal views of anterior region. (C) Parapodium of setiger 15. (D) Neuropodial hook.

Of the many species of the genus *Prionospio* now known, three are similar to *P. tetelensis* in possessing four pairs of pinnate branchiae on setigers 2 to 5. These are *P. treadwelli* Hartman, *P. tenuis* (Verrill) – both from the Atlantic coast of North America – and *P. peruana* Hartmann-Schröder from Peru. *P. tetelensis* may be distinguished from all three species on the basis of a combination of characters, namely, the prostomial keel between peristomial folds extending to setiger 3, the lateral wing-like expansions of the peristomium, the membraneous ridges across the dorsum of setigers 6 to 20 and the neuropodial hooks being present from setiger 20.

HABITAT. Mud from LWM to 18 m depth.

RECORDS. Tetel Is. – 1; ML 68 – 1; ML 188 – 1 (holotype); ML 195 – 1; ML 228 – 1.

British Museum (Natural History) Registration No. Holotype 1970·57
Paratypes 1970·58–61

Pseudopolydora corallicola Woodwick, 1964

Pseudopolydora corallicola Woodwick, 1964 : 151, fig. 2. 9–12.

HABITAT. Coralline mud at LWM; silty sand at 2 m depth.

RECORDS. Matiu Is. – 1; ML 196 – 1.

NOTES. Both specimens are small (under 5 mm long) and are damaged. Those characters that can be checked, such as the prostomial ridge extending to setiger 6, the modified setae of setiger 5 and the peculiar fenestrated neuropodial hooks, all correspond.

DISTRIBUTION. Marshall Islands.

Pseudopolydora sp.

HABITAT. In brackish water (5·6 ‰) – boring in sponge.

RECORDS. Lagoon at the mouth of the Lunga River at Lunga Point – numerous specimens.

NOTES. These specimens are up to 5 mm in length. The modified setae of setiger 5 include an anterior row of broad-winged, sharply tapering setae and a posterior row of stout hooks with recurved tips: there are 6 or 7 pairs of the two types. Branchiae commence on setiger 6 and extend to setigers 16 or 17 (11 or 12 pairs). Neuropodial hooks are present from setiger 8. In the posterior notosetae there are one or two stout, curved hooks which arch over the dorsum.

Mr. W. J. Light has examined this series and, in a personal communication, he has pointed out that certain characters, in particular the form of the modified setae on setiger 5 and also the presence of specialized posterior notosetae, indicate that these specimens represent a new species of *Pseudopolydora*. He has kindly consented to publish a description in a separate paper.

Scolelepis squamata mendanai n. subsp.

DESCRIPTION. The holotype is a complete specimen measuring 50 mm in length for about 200 segments. The diameter of the body is between 1·0 to 1·5 mm. The palps are very small and slender extending only to setiger 3 or 4. There are four eyes set in a transverse row across the prostomium. Branchiae commence on setiger 2 and are fused to the notopodial lamellae for about one-third of their length. Bidentate hooks number 9 or 10 in the neuropodia from about setiger 45, and 1 to 3 in the notopodia starting between setigers 90 to 100. The post-setal neuropodial lobes are ear-shaped in anterior segments but become bilobed between setigers 35 to 45 and are distinctly divided in the middle segments.

The subspecies *mendanai* is distinct from the stem species (Fauvel, 1927 : 36, fig. 11. g-n, as *Nerine cirratulus*) in the following characters: (i) the palps are very small reaching only to setiger 3 (not setiger 24), (ii) neuropodial hooks are present from setiger 45 (not setiger 40) and (iii) notopodial hooks are present from about setiger 90 (not setiger 60). The subspecies *saipanensis* (Hartman, 1954*a* : 230, fig. 2. a-e, as *Nerine cirratulus saipanensis*) differs in that the hooks appear in the neuropodia from setigers 29 to 31 and in the notopodia from setiger 41.

HABITAT. Silty sand, MTL to LWM.

RECORDS. Graham Pt. – 5; Fintry Pt. – 6 (including holotype).

British Museum (Natural History) Registration No. Holotype 1970·62
Paratypes 1970·63–65

Spio filicornis (Müller, 1776)

Spio filicornis: Fauvel, 1927 : 43, fig. 15. a-g; Imajima & Hartman, 1964 : 289; Day, 1967 : 481, fig. 18.6. l-o.

HABITAT. Coralline mud at LWM.

RECORDS. Matiu Is. – 8.

DISTRIBUTION. North Atlantic; South Africa; North Pacific.

Family **MAGELONIDAE**

Magelona japonica Okuda, 1937

Magelona japonica Okuda, 1937 : 247, figs 23–24; Imajima & Hartman, 1964 : 290; Tampi & Rangarajan, 1964 : 113, figs 44–49.

HABITAT. Coarse sand below LWM.

RECORDS. Tetel Is. – 2.

DISTRIBUTION. Bay of Bengal; North Pacific.

Magelona sp.

HABITAT. Silty sand at 2 m depth.

RECORD. ML 283 – 1.

NOTES. The specimen is an anterior fragment of 20 segments. The prostomium is elongated with a rounded anterior margin lacking frontal horns. Anterior segments have large notopodial and small neuropodial lamellae. The setae of segment 9 are unspecialized. From setiger 10 the parapodial lamellae are rhomboidal. The abdominal hooded hooks are bidentate with a single tooth above the main fang.

The specimen is close to *M. capensis* Day, differing in the shape of the abdominal lamellae being rhomboidal not oval and in the hooks being bidentate not tridentate.

Family **TROCHOCHAETIDAE**

Poecilochaetus serpens honiarae n. subsp.

DESCRIPTION. All of the specimens are incomplete; the largest specimen (the holotype) is 20 mm long with 44 segments and has a body width of 2·0 mm. The characters are those of the stem species (Allen, 1904 : 79, pl. 7–12, text-fig. 1) except that the aristate spines, with knobbed ends and hairy terminal aristae (Allen, 1904 : pl. 9, fig. 18) commence between setigers 20 to 25 and thus are not confined to the posterior region beyond setiger 80, as in the stem species.

HABITAT. Silty and coarse sand, MTL to LWM.

RECORDS. Tetel Is. – 3 (including holotype); Komimbo Bay – 2.
British Museum (Natural History) Registration No. Holotype 1970·66
Paratypes 1970·67–69

NOTES. The Solomon Islands specimens have a reddish, chitinous, triangular plate on the dorsum of setiger 9 (a similar, but diamond-shaped, structure has been noted in *P. johnsoni* by Hartman, 1939). Lateral sense organs are missing from setigers 6 to 9 and the branchiae, composed of two filaments on the posterior sides of the parapodia, are present from setigers 17 or 18.

An examination of *P. serpens* individuals from the type locality at Plymouth reveals that Allen overlooked the dorsal plate on setiger 9 and also the absence of lateral sense organs on setigers 6 to 9. Allen states that there are two pairs of branchial filaments from setiger 21 but in the several specimens which have been examined there is only one pair, although a third filament sometimes occurs after setiger 32.

Thus adult specimens of the stem species *P. serpens* from the type locality and adults of the subspecies *honiarae* from the Solomon Islands are very similar, the distinguishing feature being the presence of aristate spines in the middle body segments of the latter. This distinction is recognized as a minor one, deserving of subspecific separation only.

P. serpens is remarkable in its retention of the pelagic habit until a late stage of larval development. Thus it is not surprising that the existence of this species in the Indo-west Pacific region was known from plankton records long before adult specimens were discovered in the region. Pelagic stages have been described from Indo-China (Fauvel, 1939) and India (Banse, 1959; Ganapati & Radhakrishna, 1958). Only recently has an adult specimen been discovered in Indian waters (Achari, 1968).

Poecilochaetus tropicus Okuda, 1935

Poecilochaetus tropicus Okuda, 1935 : 289, figs 1–2; 1937a : 294, figs 39–40.

HABITAT. Silty and coarse sand from MTL to LWM.

RECORDS. Tetel Is. – 5; Graham Pt. – 1.

NOTES. *P. tropicus* was described from an incomplete specimen of 39 segments taken in the Palau Islands in 1934. No further material appears to have been recorded since that date.

All of the Solomon Islands specimens are incomplete. The most complete individual is immature, measuring 26 mm long for 70 setigers, but the largest specimen appears mature and has a length of 30 mm for 50 setigers. The original description can be supplemented with the following details – (i) the two branchial filaments situated on the posterior sides of the parapodia are not present in small specimens but are conspicuous in mature individuals; (ii) on the dorsal surface of setiger 9, there is a small, yellowish, semi-lunar-shaped plate (a similar structure to that in *P. serpens*); (iii) the flask-shaped parapodial lobes of setigers 7 to 13 contain an iridescent, light blue material in mature specimens, (iv) the spines with hairy terminal filaments (Okuda, 1935, fig. 2.e) are not replaced by the knobbed, aristate type (as in *P. serpens*) in the region anterior to setiger 70 in the most complete specimen available.

DISTRIBUTION. Palau Islands.

Family **CHAETOPTERIDAE**

Chaetopterus variopedatus (Renier, 1804)

Chaetopterus variopedatus: Fauvel, 1927 : 77, fig. 26. a-n; 1953 : 337, fig. 175. a-n; Day, 1967 : 529, fig. 22.2. a-g.

Habitat. Attached to *Acropora* on wharf piles; in sand at 2 m depth.

Records. Yandina – 5; ML 118 – 2.

Note. All of the specimens are small, the largest being only 20 mm long.

Distribution. Cosmopolitan.

Mesochaetopterus sagittarius (Claparède, 1870)

Mesochaetopterus minutus Potts, 1914 : 963, pl. 2, fig. 4, pl. 3, figs 7–8, text-figs 4–5; Fauvel, 1953 : 342, fig. 178. a; Day, 1967 : 531, fig. 22.2. h-n.
Mesochaetopterus sagittarius: Bhaud, 1969 : 325, fig. 1. a-f.

Habitat. A wide variety of deposits from coralline mud to coarse sand, MTL to LWM; in *Halichondria* at 5 m depth.

Records. Tetel Is. – 25; Komimbo Bay – 22; Matiu Is. – 1; Maraunibina Is. – 2; Graham Pt. – 1; Pigeon Is. – num.; Fintry Pt. – 8; Yandina – num.

Notes. The type specimens measure 25 mm long with a diameter of 1 mm (Potts, 1914) but Monro (1931) records specimens from N.E. Australia that are twice this size (50 × 2 mm) with tubes up to 20 cm in length. Some of the specimens from Tetel Is. and Komimbo Bay, and all of those from Pigeon Is. and Yandina are similar in size to the type material but the remaining specimens are larger and approximate the size of the Barrier Reef specimens.

Distribution. Mediterranean; Indo-west-Pacific to Japan.

Phyllochaetopterus elioti Crossland, 1903

Phyllochaetopterus elioti Crossland, 1903 : 172, pl. 16, figs 1–4, 7–8, pl. 17, figs 10–13; Fauvel, 1953 : 340, fig. 177. e-h; Day, 1967 : 525, fig. 22.1. f-g.

Habitat. Abundant in silty sand, MTL to LWM; coarse sand at 4 m depth.

Records. Tetel Is. – num.; Fintry Pt. – num.; ML 295 – 1.

Distribution. South and East Africa; India.

Phyllochaetopterus herdmani (Hornell, 1903)

Phyllochaetopterus herdmani: Willey, 1905; 292, pl. 5, figs 127–132; Fauvel, 1953 : 342, fig. 177. i-m; Day, 1967 : 524, fig. 22.1. a-e.

HABITAT. Silty sand at MTL.

RECORD. Tetel Is. – 1.

NOTE. The single specimen is rather damaged and in a poor state of preservation but nevertheless corresponds to the species description. It is anterior fragment of 31 setigers comprising 11 anterior, 2 middle and 18 abdominal segments. On setiger 4 there are 9 modified setae in each of the notopodia. This is a first record for the Pacific region.

DISTRIBUTION. East Africa; Ceylon.

Phyllochaetopterus socialis Claparède, 1870

Phyllochaetopterus socialis: Fauvel, 1927 : 84, fig. 30. a-l; 1953 : 339, fig. 176. a-l; Day, 1967 : 525, fig. 22.1. h-r.

HABITAT. Very abundant on moderately exposed reef platforms, forming dense colonies towards LWM (see Gibbs, 1969, fig. 136); single specimens embedded in *Millepora* and the sponge *Neofolitispa dianchora* (de Laubenfels) from 5 m depth.

RECORDS. Matiu Is., Cape Esperance and Batuona Is. – numerous specimens; Maramasike Pg. – 3; Kokomtambu Is. – 1; Yandina – 1.

DISTRIBUTION. Mediterranean; Atlantic; Indo-Pacific.

Spiochaetopterus costarum costarum (Claparède, 1868)

Telepsavus vitrarius Ehlers, 1908 : 114, pl. 15, figs 1–8.
Spiochaetopterus vitrarius: Day, 1967 : 528, fig. 22.1. u-v.
Spiochaetopterus costarum costarum: Gitay, 1969 : 14 (synonymy).

HABITAT. Silty sand (*Thalassia* flat) at about MTL; coarse sand at LWM.

RECORDS. Tetel Is. – 6; Komimbo Bay – 14.

NOTES. The specimens have a rounded prostomium with a pair of lateral eyes. The anterior region is composed of 9 setigers, the notopodia of setiger 4 bearing single modified setae with swollen, triangular or heart-shaped tips. On the ventral surface of setigers 7 to 9 the tissue is distinctly glandular, being brownish-black in colour on setiger 7 but whitish on setigers 8 and 9. On setiger 2 there is usually a thin line of brownish pigment across the ventrum. Up to 19 middle and 25 abdominal segments have been noted in several specimens but most of the material is poorly preserved. The largest specimens measure about 25 mm in length, their tubes being up to 60 mm long and 0·5 to 1·0 mm in diameter. The latter are transparent and highly wrinkled.

Gitay (1969) has recognized three subspecies of S. *costarum* in the Pacific region, namely *pottsi*, *monroi* and *okudai*. The specimens from the Solomon Islands differ from all three in having fewer middle segments (i.e. 19 compared to 30–90, about 50 and about 67 respectively). Furthermore their small size distinguishes them from *pottsi* and the presence of eyes separates them from *monroi* and *okudai*. However these specimens appear to be identical with *T. vitrarius* Ehlers, known from the eastern Atlantic and Natal, which Gitay considers to be a synonym of *S. costarum costarum*.

DISTRIBUTION. Eastern Atlantic; Mediterranean; Indian Ocean.

Family **CIRRATULIDAE**

Cirriformia filigera (Delle Chiaje, 1825)

Audouinia filigera: Fauvel, 1927 : 92, fig. 32. h-m; 1953 : 331, fig. 173. h-l.
Cirriformia filigera Day, 1967 : 518, fig. 20.4. p-q.

HABITAT. In *Acropora* rubble and under coral boulders on reef platforms; in crevices and vacated borings in *Porites*, *Acropora* and beachrock.

RECORDS. Kokomtambu Is. – 1; Tetel Is. – 3; Komimbo Bay – 3; Matiu Is. – 1; Paleki Is. – 2; Lauvie Is. – 2.

DISTRIBUTION. Atlantic; Mediterranean; Indian Ocean.

Cirriformia punctata (Grube, 1859)

Audouinia semicincta: Fauvel, 1953 : 330 fig. 174. c; Okuda, 1937 : 296, fig. 41. a-c.
Cirriformia punctata: Day, 1967: 517, fig. 20.4. j-m.

HABITAT. In sedimented crevices on reef platform.

RECORDS. Komimbo Bay – 1; Batuona Is. – 54.

DISTRIBUTION. Circumtropical.

Dodecaceria fistulicola Ehlers, 1901

Dodecaceria fistulicola: Fauvel, 1953 : 335, figs 169. h-i, 174. a-b; Okuda, 1937 : 298, fig. 42. a-f.

HABITAT. Crevices in reef platform.

RECORDS. Komimbo Bay – 1; Matiu Is. – 1.

Notes. A complete specimen has 68 segments and is about 15 mm long. There are 4 or 5 pairs of branchiae which are shorter than the palps. The first 7 or 8 setigers carry capillary setae which are replaced in later segments by 5 or 6 hooks in both rami.

Distribution. Indo-west-Pacific; southern South America.

Dodecaceria laddi Hartman, 1954

Dodecaceria laddi Hartman, 1954 : 638, figs 176. c, 177. d-h; Day, 1967 : 502, fig. 20.1. g-i.

Habitat. Boring (?) in *Porites*.

Record. Kokomtambu Is. – 1.

Distribution. Marshall Islands; South Africa.

Tharyx sp.

Habitat. Silty sand at 36 m depth.

Record. Off Fintry Pt. – 1.

Notes. The specimen is incomplete with 26 segments and measures 3·5 mm long. The diameter is about 0·4 mm. The palps have been lost but scars indicate their position. The setae are entirely capillary. It is impossible to identify this fragment with any certainty but possibly it is *T. multifilis* Moore, which is known from Madras (Fauvel, 1953).

Family **COSSURIDAE**

Cossura coasta Kitamori, 1960

Cossura coasta Kitamori, 1960 : 1082, fig. 1. a-f; Imajima & Hartman, 1964 : 299; Day, 1967 : 581, fig. 26.1. a-d.

Habitat. Mud at 22 m depth.

Record. ML 37 – 2.

Notes. Both specimens are incomplete; the larger measures 10 mm for 60 segments and has a diameter of 0·5 mm. They differ from the species description only in respect of the shorter capillary setae which, instead of being serrated, are smooth, and also taper quite abruptly about halfway along their length to a very slender filament.

Distribution. Southern Africa; Japan.

Family FLABELLIGERIDAE

Diplocirrus glaucus orientalis n. subsp.

DESCRIPTION. The specimen chosen for the holotype (from ML 194) is 18 mm long for 25 segments and has a maximum diameter of about 2·0 mm in the anterior body region. A complete paratype (from ML 55) is 20 mm in length for 40 segments. The characters are those of the stem species *Diplocirrus glaucus* (Malmgren), (Fauvel, 1927 : 120, fig. 43. a-d) but is distinguished by the presence of conspicuous orange coloured, globular papillae situated on the ventral surface below each neuropodium from setiger 4 to setigers 14 or 16.

HABITAT. Mud and silty sand, 11 to 24 m depth.

RECORDS. ML 55 – 1; ML 188 – 3; ML 194 – 1 (holotype); ML 218 – 1; ML 230 – 1.

British Museum (Natural History) Registration No. Holotype 1970·70
Paratypes 1970·71–74

NOTES. The stem species is widely distributed in the North Atlantic region and, although Fauvel (1932) refers a specimen dredged in the Mergui Archipelago from 7 m (4 fm) to this species 'with great hesitation', no certain record of this species being taken in the Indian Ocean exists.

Specimens of the stem species from Plymouth do not possess conspicuous papillae below the neuropodia of the anterior segments. The presence of these papillae thus distinguishes the subspecies *orientalis*.

Family SCALIBREGMIDAE

Hyboscolex longiseta Schmarda, 1861

Hyboscolex longiseta Schmarda, 1861 : 54, pl. 27, fig. 211, with text-figs; Day, 1967 : 588, fig. 27.2. a-d.

HABITAT. Under coral boulders in muddy silt; in beachrock.

RECORDS. Tetel Is. – 1; Maraunibina Is. – 1; Lauvie Is. – 2.

DISTRIBUTION. Southern and East Africa; New Zealand (Auckland Is.).

Scalibregma inflatum Rathke, 1843

Scalibregma inflatum: Fauvel, 1927 : 123, fig. 44. a-f; 1953 : 355, fig. 185. a-f; Day, 1967 : 590, fig. 27.2. e-i.

HABITAT. Silty mud at 13 m depth.

RECORD. ML 69 – 1.

DISTRIBUTION. Cosmopolitan (but few records from the Indo-Pacific region).

Family **OPHELIIDAE**

Armandia lanceolata Willey, 1905

Armandia lanceolata Willey, 1905 : 288, pl. 5, fig. 120; Fauvel, 1953 : 358.

HABITAT. *Acropora* rubble at LWM; silt and sand, 5–24 m depth.

RECORDS. Tetel Is. – 1; ML 56 – 1; ML 117 – 1; ML 134 – 1; ML 229 – 1; ML 230 – 1.

DISTRIBUTION. Indo-west-Pacific.

Armandia leptocirrus (Grube, 1878)

Ophelina (*Armandia*) *leptocirrus* Grube, 1878 : 194.
Armandia leptocirrus: Fauvel, 1953 : 358; Day, 1967 : 577, fig. 25.2. h.

HABITAT. Silt and coralline mud at LWM; mud and sand, 2–18 m depth.

RECORDS. Komimbo Bay – 1; Matiu Is. – 7; ML 68 – 2; ML 97 – 1; ML 118 – 1; ML 190 – 2; ML 192 – 1; ML 196 – 3; ML 283 – 4.

DISTRIBUTION. Tropical Indo-west-Pacific.

Armandia longicaudata (Caullery, 1944)

Ammotrypane longicaudata Caullery, 1944 : 44, fig. 35. a-c.
Armandia longicaudata: Day, 1967 : 577, fig. 25.2. a-c.

HABITAT. Silty sand at 24 m depth.

RECORD. ML 230 – 1.

DISTRIBUTION. East Africa; East Indies.

Ophelia koloana n. sp.

(Fig. 14. A–B)

DESCRIPTION. The two type specimens measure 10 to 12 mm in length and have a diameter between 1·0–1·5 mm. The paratype is a female approaching maturity, containing coelomic oocytes.

The prostomium is sharply pointed. The anterior region is cylindrical with the ventral groove commencing at setiger 8. The first 9 setigers are abranchiate, branchiae being present from setiger 10 to setiger 27 (i.e. there are 18 pairs). Each branchia is rather small and has a 'crimped' appearance (fig. 14. A). The branchiferous region is followed by 4 abranchiate segments and then two achaetous annuli (or pre-anal segments). Thus, following the scheme of Tebble (1953), the body formula is 9a + 18b (—) + 4a + 2n = 33. From setiger 30 to the pygidium there is a pair of prominent dorso-lateral ridges (fig. 14. B). The pygidium bears two stout ventral papillae and 9 small dorsal ones. Neither nephridiopores nor branchial fenestrations in the lateral body wall could be detected.

In terms of its affinities, *O. koloana* has a similar body formula to *O. denticulata* Verrill and *O. capensis* Kirkegaard. However in *O. denticulata*, which is an Atlantic species, the ventral groove starts at segment 10 and it has 11 to 18 dorsal anal papillae (Fauvel, 1927 : 132, fig. 46, g-h, as *O. neglecta*, *fide* Tebble, 1953). *O. capensis* from South Africa differs in that it has lateral swellings from segment 26 to the pygidium (Kirkegaard, 1959 : 45, fig. 8) not dorso-lateral ridges from setiger 29.

HABITAT. Sand at 2 m depth.

RECORDS. ML 118 – 2.

British Museum (Natural History) Registration No. Holotype 1970·75
Paratype 1970·76

NOTE. Hitherto the genus *Ophelia* appears to have been recorded only once in the tropical Indo-west-Pacific region, namely, a single specimen of *O. limacina* from Indo-China (Fauvel, 1939).

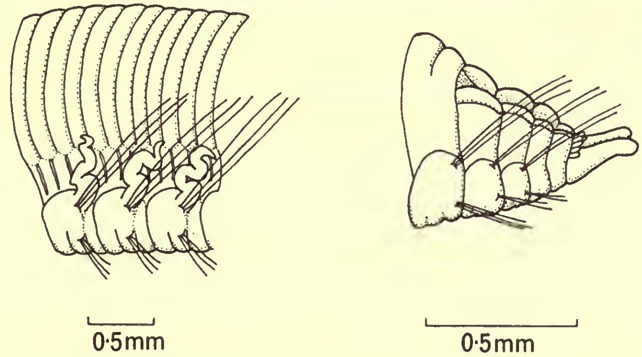

FIG. 14. *Ophelia koloana* n.sp. (A) Lateral view of segments 22 to 24. (B) Dorso-lateral view of posterior region.

Polyophthalmus pictus (Dujardin, 1839)

Polyophthalmus pictus: Fauvel, 1927 : 137, fig. 48. l-o; 1953 : 360, fig. 187. l-o; Day, 1967 : 579, fig. 25.2. k-m.

HABITAT. Interstices of the sponge *Halichondria* at 5 m depth.

RECORDS. Yandina – 3.

Notes. All three specimens appear to be juvenile in that they measure only 3 to 7 mm in length. Pillai (1965) found this species in a similar habitat, namely, within sponges and other encrusting organisms on bamboo oyster spat collectors.

Distribution. Cosmopolitan.

Family **STERNASPIDAE**

Sternaspis scutata (Renier, 1807)

Sternaspis scutata: Fauvel, 1927 : 216, fig. 76. a-g; 1953 : 401, fig. 210. a-g; Day, 1967 : 648, fig. 31.1. a-d.

Habitat. Mud and silty sand, 18–24 m depth.

Records. ML 218 – 6; ML 230 – 3.

Distribution. Cosmopolitan.

Family **CAPITELLIDAE**

Capitellethus dispar (Ehlers, 1907)

Capitellethus dispar: Fauvel, 1953 : 371; Rullier, 1965 : 194.

Habitat. Silty sand above LWM.

Records. Komimbo Bay – 3.

Notes. The material is fragmentary and the largest specimen measures 18 mm long for 60 segments. The peristomium is achaetous and there are 11 thoracic setigers with capillary setae in both rami, which are replaced by hooks from setiger 12. No branchiae could be seen. In all three specimens the epidermal cells of setigers 11 and 12 (the last thoracic and first abdominal) contain a dark pigment.

Distribution. India; West Pacific.

Capitobranchus sp.

Habitat. Coarse sand at LWM.

Record. Tetel Is. – 1.

Notes. The single specimen is incomplete, measuring 20 mm for 20 segments, and has a diameter of about 2 mm. The peristomium is biannulate, segments 2 to 4 are triannulate, segments 5 to 8 are quadriannulate and the remaining segments are biannulate. Segments 2 and 3 are achaetous but may have lost their setae. Segments 4 to 12 have capillaries in both rami which are replaced by hooks in the neuropodia from segment 13.

In having at least 19 thoracic segments and hooks from setiger 13 (assuming segments 2 and 3 to have been setigerous), the specimen falls within the broad definition of the genus *Capitobranchus* given by Day (1962, p. 651) as follows: "Thorax with an achaetous peristome followed by about 19 setigerous segments most of which bear capillary setae in both rami, but hooded hooks are present in the last few neuropodia." The genus is monospecific based on *C. macgregori* from Madagascar which has 19 thoracic setigers, the last four of which bear neuropodial hooks. Due to its incomplete nature, the specimen from Tetel Island must remain indeterminable as to species until further material becomes available.

Dasybranchus caducus (Grube, 1846)

Dasybranchus caducus: Fauvel, 1927 : 148, fig. 52. a-h; 1953, 365, fig. 190. a-h; Day, 1967 : 603, fig. 28.3. e-h.

HABITAT. A wide variety of deposits, mud to coarse sand, particularly under coral boulders on reef platforms, from above MTL to LWM; mud, 9–22 m depth.

RECORDS. Tetel Is. – 56; Nggela Is. (Sandfly Pg.) – 30; Naro Bay – 7; Komimbo Bay – 14; Matiu Is. – 16; Graham Pt. – 19; Fintry Pt. – 7; ML 29 – 2; ML 56 – 1.

DISTRIBUTION. Atlantic; Mediterranean; Indo-Pacific.

Mastobranchus dollfusi Fauvel, 1936

Mastobranchus dollfusi Fauvel, 1936 : 81, fig. 11. a-g; Kirkegaard, 1959 : 51.

HABITAT. Muddy sand at MTL; mud and silty sand, 2–22 m depth.

RECORDS. Nggela Is. – 4; ML 29 – 1; ML 68 – 5; ML 195 – 1.

NOTES. Specimens have a diameter of 0·5 to 1·0 mm and the largest anterior fragment is 30 mm long for 70 segments. The prostomium is conical with a pair of pigmented eye-spots and is followed by an achaetous peristomium. The first setiger has capillary notosetae only; setigers 2 to 10 have capillaries in both rami. The number of thoracic setigers varies, as noted by both Fauvel and Kirkegaard for the West African material. In the Solomon Islands specimens setiger 11 usually has capillary notosetae and neuropodial hooks with the succeeding segments carrying hooks in both rami. However two specimens have capillary notosetae on setiger 12, one of which also has capillary neurosetae on setiger 11. A fragment of the posterior region possesses retractile branchiae situated posteriorly to the notopodia of the abdominal segments, and the pygidium has four short anal cirri.

Despite the wide geographical separation of the two localities, the Solomon Islands specimens appear to be identical to those from West Africa in all details.

DISTRIBUTION. West Africa.

Mastobranchus trinchesii Eisig, 1887

Mastobranchus trinchesii: Fauvel, 1927 : 152, fig. 54. a-i; Kirkegaard, 1959 : 52.

HABITAT. Silty sand, MTL to LWM.

RECORDS. Tetel Is. – 1; Komimbo Bay – 4; Graham Pt. – 27.

NOTES. Although *M. trinchesii* is a species hitherto known only from the Mediterranean and West Africa, the Solomon Islands specimens appear to be identical. Briefly, the latter specimens have an achaetous peristomium, followed by 11 thoracic setigers with capillary setae in both rami, except the first which has notosetae only. From setiger 12 the capillaries are replaced by hooks in the neuropodia, but in the notopodia capillaries persist with the hooks until about setiger 90. Retractile cirriform branchiae are present in the posterior segments and the pygidium carries four anal cirri.

DISTRIBUTION. Mediterranean; West Africa.

Mediomastus sp. cf. ***capensis*** Day, 1961

Mediomastus capensis Day, 1961 : 518, fig. 11. a-d; 1967 : 600, fig. 28.2. n-p.

HABITAT. Mud at 18 m depth.

RECORD. ML 218 – 1.

NOTES. The specimen is an anterior fragment of 25 segments, measuring 7 mm in length. An achaetous peristomium is followed by 10 thoracic setigers, the first four of which have capillaries, the remaining six having hooks only. Although conforming to the description of the South African material, the identity of the specimen must remain provisional, due to its fragmentary condition.

Notomastus sp.

HABITAT. Sand, 2–9 m depth.

RECORDS. ML 97 – 1; ML 118 – 1.

NOTES. Both specimens are anterior fragments consisting of 11 thoracic setigers and a few abdominal segments. Setigers 1 to 4 are triannulate and setigers 5 to 11 are quadriannulate. The thoracic segments are strongly areolated, particularly the more anterior ones. The abdominal tori are well developed. A specific identification cannot be made with any certainty because of the absence of branchiferous segments.

Family **ARENICOLIDAE**

Abarenicola claparedii claparedii (Levinsen, 1883)

Arenicola claparedii: Fauvel, 1927 : 163, fig. 57. k-n.
Abarenicola claparedii: Wells, 1959 : 307, fig. 2.

HABITAT. Coralline silty mud at LWM.

RECORD. Matiu Is. – 1.

NOTES. The single specimen was kindly examined by Prof. G. P. Wells who identified it, from its superficial characters only, as one of the cystless species of *Abarenicola*, probably *claparedii claparedii*. This determination will have to be confirmed on the basis of its internal anatomy.

DISTRIBUTION. Mediterranean.

Family **MALDANIDAE**

The following descriptions of the maldanid material are based on notes provided by Dr. Charlotte Mangum.

Subfamily **EUCLYMENINAE**

Clymenella (=Macroclymene) sp. 1

HABITAT. Silty shell gravel on *Thalassia* flat.

RECORD. Graham Pt. – 1.

NOTES. The specimen is incomplete (the head and probably five anterior setigers are missing) and has 48 setigers plus a caudal funnel. The latter carries long and short cirri, which are arranged in an alternating pattern of one long, two short, one long, two short and so on, in addition to a median ventral cirrus that is 1·5 to 2·0 times the length of the long cirri. Posterior pre-anal achaetous segments are absent.

Clymenella (=Macroclymene) sp. 2

HABITAT. Under boulder in muddy silt at LWM.

RECORD. Komimbo Bay – 1.

NOTES. An anterior fragment composed of 27 setigers is available. It has a cephalic plaque with nuchal organs extending nine-tenths of its length. Prostomial pigment spots are absent. There are shallow clefts in the medial and posterior margins of the cephalic rim. Uncini are present on all setigers including the first three.

Clymenella (=Euclymene) sp.

HABITAT. Silty sand with coral debris on lower shore.

RECORD. Komimbo Bay – 1.

NOTES. The specimen is complete with 19 setigers plus one or two posterior achaetous segments. A cephalic plaque is present, the rim of which has six well defined lobes along the dorsal margin. There are a few prostomial pigment spots. Setigers 1 to 3 each have a single large aciculum. A caudal funnel is present and this carries a median ventral cirrus that is more than 1·5 times the length of the other cirri. Questionably identified as *Praxillella köllikeri* (McIntosh, 1885, as *Praxilla köllikeri*).

Praxillella sp.

HABITAT. Silty fine coral sand at LWM.

RECORD. Matiu Is. – 1.

NOTES. The complete specimen has 19 setigers plus two posterior achaetous segments. A cephalic plaque is developed with nuchal organs extending over nine-tenths of its length. The cephalic rim has posterior clefts only. Pigment spots on the prostomium are profuse. There are three or four uncini on setigers 1 and 2 and four on setiger 3. A caudal funnel is not present. The anal plug is just protruding and is surrounded by cirri of equal length. The specimen resembles *P. affinis* (Sars) but is probably a new species.

Euclymeninae sp. A

HABITAT. Muddy sand at 9 m depth.

RECORD. ML 56 – 1.

NOTES. This specimen is an anterior fragment of nine setigers. The cephalic plaque has nuchal organs extending across three-quarters of its length. Prostomial pigment spots are absent. The first setiger is not clearly separated from the prostomium. One pair of acicula is present on setiger 1, two pairs on setiger 2 and one or two pairs on setiger 3, with uncini on the following segments.

Euclymeninae sp. B

HABITAT. Between boulders in muddy silt at MTL.

RECORD. Tetel Is. – 1.

NOTES. This incomplete specimen is composed of the prostomium and eight setigers. The nuchal organs extend for nine-tenths of the length of the cephalic plaque and there are very shallow clefts around the medial and posterior margins of the cephalic rim. Pigment spots are present ventrally. Setiger 1 has one pair of acicula and setigers 2 and 3 have two pairs, the subsequent setigers having uncini.

Euclymeninae sp. C

HABITAT. Silty sand at 24 m depth.

RECORD. ML 230–1.

NOTES. The specimen is fragmentary, consisting of 15 anterior setigers. The cephalic plaque is unusual in having pigment spots within the plaque as well as on the ventral surface. The cephalic rim is very high and has posterior clefts only.

Subfamily NICOMACHINAE

? ***Nicomache*** sp.

HABITAT. Coarse coral sand below LWM.

RECORDS. Tetel Is. – 2.

NOTES. The material consists of two large anterior fragments with seven and eight setigers. They appear to be identical except that one specimen has only large setae on setigers 1 to 3 but the other specimen has four small setae on setiger 1, a small (left) and a large (right) seta on setiger 2 and one large seta on either side of setiger 3. The latter specimen may be abnormal due to aberrant growth or regeneration. In both specimens the first three setigers are light, the rest being grey-brown to dark in colour.

Family OWENIIDAE

Myriochele eurystoma Caullery, 1944

(Fig. 15. A)

Myriochele eurystoma Caullery, 1944 : 52, fig. 42. a-d, f.

HABITAT. Silty sand at 35 m depth.

RECORD. ML 72 – 1.

NOTES. The specimen is an anterior fragment about 15 mm long and has a diameter of 0·5 mm. It has a large mouth with a prominent buccal organ on its ventral margin (fig. 15. A). The prostomium and anterior segments are pigmented reddish-brown, with two eye-spots situated ventro-laterally. Between the latter, running over the dorsal surface, there is a thin unpigmented band. The tube is composed chiefly of sponge spicules cemented with their long axes around the circumference of the tube, the latter having a diameter of about 1·2 mm.

The specimen is referred to *M. eurystoma* on account of its large mouth and its pigmentation. Caullery notes that a specimen from 32 m depth was pigmented but specimens from deeper waters (131–1570 m) lacked colour. The details of the posterior region are unknown.

DISTRIBUTION. East Indies.

Myriochele heruensis n. sp.

(Fig. 15. B–G)

DESCRIPTION. Of the fourteen specimens taken at ML 134, only three could be removed intact from their tubes. The holotype is 7·6 mm long for 18 segments and the two other complete paratypes measure 6·6 and 7·5 mm for 16 and 17 segments respectively. The largest specimen probably measured between 10 and 12 mm long when intact. The diameter of the worm is between 0·28 and 0·40 mm.

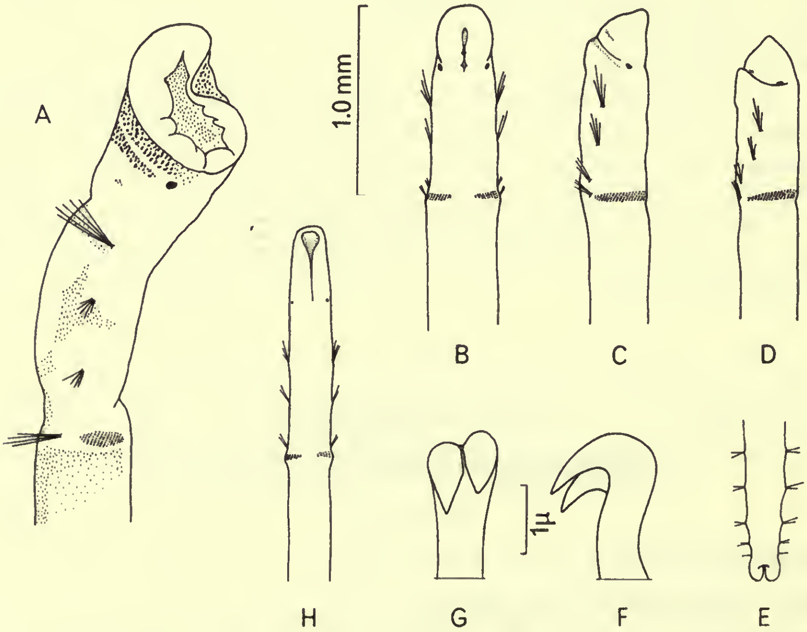

FIG. 15. *Myriochele eurystoma.* (A) Anterior region. *Myriochele heruensis* n.sp. (B–D) Ventral and lateral views of anterior region. (E) Dorsal view of posterior region. (F–G) Profile and face views of uncinus. *Myriochele* sp. (H) Ventral view of anterior region.

The prostomium is short with a rounded anterior margin (fig. 15. B). In those specimens preserved with the prostomium protracted, a shallow groove can be discerned extending across the dorsal surface of the prostomium, terminating on either side at the level of ventro-lateral eye-spots (fig. 15. C). In other specimens the prostomium is contracted, and in these the dorsal groove appears as a distinct fold (fig. 15. D). This groove or fold is quite marked in all specimens and serves as the characteristic feature of the species. In addition to the two red eye-spots, two small patches of red pigment are present on the antero-dorsal surface of the prostomium and there is also a thin red line along the posterior margin of the dorsal groove.

The first three setigers are short. From setiger 4 there is a progressive increase in the length of the segments, reaching a maximum in the middle body region, and then successive segments become shorter. The pygidium has two short, stout anal cirri (fig. 15. E).

The setae are of the usual *Myriochele* types. Notosetae are slender capillaries with short lateral processes along either side of the blade. Neurosetae, present from setiger 4, are uncini, each with two subequal teeth at the apex (fig. 15. F–G). In the middle body segments, the tori are composed of 7 or 8 vertical rows of uncini.

The tube is composed of shell fragments which are cemented with their flat surfaces at right angles to the long axis of the tube. The latter has a diameter of 0·8 to 1·0 mm and a maximum length of about 25 mm.

As noted above the distinct groove across the dorsal surface of the prostomium is sufficient to distinguish *M. heruensis* from all other species. This feature may be interpreted as a feeding adaptation in that it provides a mechanism whereby the position of the mouth can be changed.

HABITAT. Sand at 16 m depth.

RECORDS. ML 134 – 14.

British Museum (Natural History) Registration No. Holotype 1970·77
Paratypes 1970·78

***Myriochele* sp.**

(Fig. 15. H)

HABITAT. Sand at 5 m depth.

RECORD. ML 229 – 1.

NOTES. The specimen lacks posterior segments but probably measured about 12 mm long when intact. It has a diameter of 0·24 mm. The anterior margin of the prostomium is bluntly rounded and, ventrally, the mouth extends about half the prostomial length, ending at the level of two red eye-spots which are ventro-lateral in position (fig. 15. H).

The tube has a diameter of 0·4 mm and consists of sand and shell fragments cemented with their long axes along the length of the tube.

The specimen shows a general similarity to *M. minor* Caullery but differs in having eye-spots.

Owenia fusiformis Delle Chiaje, 1844

Owenia fusiformis: Fauvel, 1927 : 203, fig. 71. a-f; 1953 : 391, fig. 203. a-f; Day, 1967 : 649, fig. 31.1. e-j.

HABITAT. Medium and coarse sand, 2–18 m depth.

RECORDS. ML 96 – 3; ML 118 – 3; ML 134 – 5; ML 190 – 2; ML 192 – 13; ML 203 – 1; ML 204 – 60; ML 229 – 2; ML 283 – 1.

DISTRIBUTION. Cosmopolitan.

Family **SABELLARIIDAE**

Lygdamis ehlersi (Caullery, 1913)

Tetreres ehlersi Caullery, 1913 : 201, figs a-d.
Lygdamis ehlersi: Caullery, 1944 : 62, figs 49–50.

HABITAT. Silty sand at LWM.

RECORDS. Fintry Pt. – 5.

NOTES. The largest specimen is 50 mm long for 50 segments. The tube is constructed of gravel, shell and calcareous alga fragments. The chief characters include the following: on the operculum, there are 19 or 20 external and 6 or 7 internal paleae on each side and 10 groups of buccal cirri. The median cirrus (*lobe préoral*) is stout, longer than the palps, and has a truncated tip which is darkly pigmented a bluish-black colour. There are 13 to 15 pairs of branchiae.

Comparing these specimens with the type description they have fewer external (20 compared to 25) and internal (6 or 7 instead of 12) paleae but correspond in all other details.

Although Hartman (1959) indicates that *L. ehlersi* may be a synonym of *L. indicus* the two species appear to be distinct and separable on the form of the median cirrus. In *L. ehlersi* the median cirrus is stout, longer than the palps and has a truncated tip while in *L. indicus* this organ is shorter than the palps and tapers to a point.

DISTRIBUTION. East Indies.

Lygdamis indicus Kinberg, 1867

Lygdamis indicus: Johansson, 1925 : 8, fig. 2. 2–7; Fauvel, 1953 : 399, fig. 209. a-k; Day, 1967 : 677, fig. 33.3. c-h.

Habitat. Undersurface of coral boulder at LWM.

Record. Pirikale Is. – 1.

Notes. The specimen is 30 mm long (diameter = 4 mm) with 48 setigers. It has 37 external and 17 internal paleae on each side. The tube is a fragile structure constructed of shell fragments.

Distribution. Tropical Indo-west-Pacific.

Family **PECTINARIIDAE**

Pectinaria (Pectinaria) antipoda Schmarda, 1861

Pectinaria (*Pectinaria*) *antipoda* Schmarda, 1861 : 46, pl. 24, fig. 199, with text-figs; Pruvot, 1930 : 78, pl. 3, figs 93–95; Fauvel, 1953 : 403, fig. 211. e-g.

Habitat. Mud and sand, 4–22 m depth.

Records. ML 37 – 1; ML 203 – 1; ML 229 – 1.

Notes. All three specimens are too small (less than 10 mm) to be certain of their identity but they appear to belong to this Indo-west-Pacific species.

Distribution. Persian Gulf; West Pacific.

Family **AMPHARETIDAE**

Subfamily **MELINNINAE**

Isolda pulchella Müller, 1858

Isolda sibogae Caullery, 1944 : 102, fig. 83. a-h.
Isolda pulchella: Day, 1963 : 434 (synonymy); 1967 : 691, fig. 35.1. k-n.

Habitat. Mud and silty sand, 2–18 m depth.

Records. ML 56 – 1; ML 196 – 1; ML 218 – 1.

Distribution. Atlantic and Indian Oceans; East Indies.

Subfamily **AMPHARETINAE**

? ***Sosane wireni*** Caullery, 1944

(Fig. 16. A–B)

Sosane wireni Caullery, 1944 : 87, fig. 69. a-e.

HABITAT. Silty sand at 24 m depth.

RECORD. ML 230 – 1.

NOTES. The specimen is 7 mm long for 26 setigers of which 15 are thoracic and 11 abdominal. It is referred to *S. wireni* on account of the branchiae being arranged with three pairs in a transverse line across setiger 1 and a smaller fourth pair on setiger 2. However there is some doubt as to the identity since Caullery omits any reference to the diagnostic features of the genus, namely, the presence of (i) a nephridial papilla on the branchial ridge and (ii) specialised notosetae on elevated posterior notopodia (Day, 1964). There does not appear to be a nephridial papilla present on the Solomon Islands specimen but the notopodia of setiger 13 are elevated (fig. 16. A) and each carries about 20 modified notosetae which have a 'penicillate' appearance (fig. 16. B).

DISTRIBUTION. East Indies.

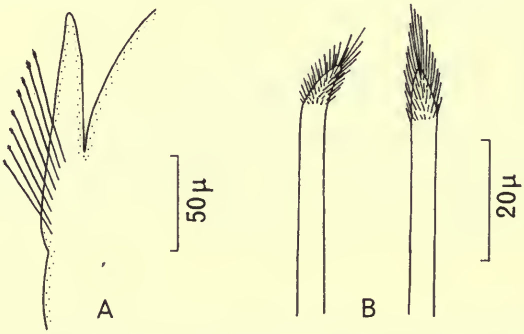

FIG. 16. ? *Sosane wireni*. (A) Elevated notopodium of setiger 13. (B) Modified notosetae from same setiger.

Family **TERELLIDAE**

Subfamily **TRICHOBRANCHINAE**

Terebellides stroemi Sars, 1835

Terebellides stroemi: Fauvel, 1927 : 291, fig. 100. i-q; 1953 : 436, fig. 231. i-q; Day, 1967 : 713, fig. 36.1. f-j.

HABITAT. Mud and silty sand, 2–24 m depth.

RECORDS. ML 155 – 31; ML 157 – 3; ML 196 – 1; ML 218 – 1; ML 230 – 3.

DISTRIBUTION. Cosmopolitan.

Subfamily **POLYCIRRINAE**

Amaeana trilobata (Sars, 1863)

Amaea trilobata: Fauvel, 1927 : 285, fig. 99. a-e.
Amaeana trilobata: Day 1967 : 718, fig. 36.3. e-h.

Habitat. Mud, 11–22 m depth.

Records. ML 29 – 1; ML 194 – 1.

Distribution. North Atlantic; Mediterranean; southern Africa; Japan.

Lysilla ubianensis Caullery, 1944

Lysilla ubianensis Caullery, 1944 : 197, fig. 156. a-e; Day, 1967 : 721, fig. 36.3. i-j.

Habitat. Silty mud, MTL to LWM, and at 13 m depth

Records. Tetel Is. – 3; Komimbo Bay – 1; ML 69 – 1.

Distribution. East Africa; East Indies.

Subfamily **THELEPINAE**

Euthelepus kinsemboënsis Augener, 1918

Euthelepus kinsemboënsis Augener, 1918 : 548, pl. 6, fig. 161, pl. 7, fig. 250, text-fig. 95; Fauvel, 1930: 553, fig. 9. a-f; 1947 : 78, fig. 75. a'-d'; Day, 1967 : 726, fig. 36.5. e-i.

Habitat. Under coral boulder on reef platform.

Record. Graham Pt. – 1.

Notes. The specimen is an anterior fragment of 34 setigers which corresponds in detail to the specimen from New Caledonia described by Fauvel except that the branchial filaments, situated on segments 2, 3 and 4, number 10, 8 and 6 respectively, not 12, 8 and 4. The type specimen from Angola has only 12 branchial filaments instead of 24, but according to Fauvel (1930) this variation is attributable to the difference in the size of the specimens.

Distribution. Angola; New Caledonia.

Subfamily **TEREBELLINAE**

Eupolymnia nebulosa (Montagu, 1818)

Polymnia nebulosa: Fauvel, 1927 : 257, fig. 89. a-g; 1953 : 419, fig. 219. a-g.
Eupolymnia nebulosa: Imajima & Hartman, 1964 : 337; Day, 1967 : 744, fig. 36.9. f-h.

Habitat. Under coral boulder on silty sand at LWM.

Record. Graham Pt. – 1.

Distribution. Atlantic; South Africa; Mediterranean; Indo-west Pacific.

Loimia medusa (Savigny, 1820)

Loimia medusa: Fauvel, 1953 : 416, fig. 218. a-f; Day, 1967 : 743, fig. 36.9. a-e.

HABITAT. A wide variety of deposits, silty mud to *Acropora* rubble, from above MTL to LWM on reef platforms; in crevices within reef platforms and amongst encrustations on wharf piles; silty sand, 9–24 m depth.

RECORDS. Tetel Is. – 3; Komimbo Bay – 9; Mamara Pt. – 1; Matiu Is. – 1; Lauvie Is. – 6; Fintry Pt. – 9; Yandina – 2; Maramasike Pg. – 1; ML 69 – 1; ML 96 – 1; ML 230 – 1.

NOTES. The largest specimens, up to 40 cm in length with over 200 segments, were found in coral debris deposits (chiefly *Acropora* fragments) on reef platforms. Their tubes were loosely constructed of *Halimeda*, coral and shell fragments and extended to a depth of over 30 cm. Although conspicuous on account of their white feeding tentacles spread over the surface, specimens are difficult to capture in this habitat because of their ability to rapidly withdraw to the bottom of their deep tubes when disturbed. However smaller specimens which are commonly found under coral boulders lying in silty mud are easily taken.

DISTRIBUTION. Cosmopolitan in temperate and tropical waters.

Pista dibranchis n. sp.

(Fig. 17. A–E)

DESCRIPTION. A specimen from Tetel Island has been selected for the holotype. It is incomplete and measures 12 mm for 32 segments. The largest of the paratypes is 40 mm long for 130 segments. The body diameter is about 1·0 mm.

The tentacular lobe bears numerous tentacles and is without eye-spots. Semicircular lateral lobes are present on segments 2 and 3. A pair of stalked branchiae arises from the anterior margin of the second segment and each has numerous filaments arranged spirally, with a maximum of 6 or 7 whorls, around the central stalk (fig. 17. A); often one of the pair is much larger than the other. In larger specimens the nephridial papillae on segments 6 and 7 (setigers 3 and 4) are conspicuous.

Notosetae commence on segment 4 and extend to segment 20 (setiger 17). Each bundle consists of broad-winged, smooth-tipped capillaries of two types, namely, a longer stout-shafted form (fig. 17. B) and a shorter, slender form with a recurved tip (fig. 17. C). There are usually about 11 of each type in a bundle. Uncini start on segment 5 (setiger 2) and are arranged in single rows on the anterior segments, becoming alternate in the posterior thorax. Uncini are of similar form throughout the thorax and each has 5 to 7 teeth surmounted by 15 to 20 smaller teeth above the main fang (fig. 17. D, E). The dental formula is thus: MF : 5–7 : 15–20. The uncini lack basal prolongations or shafts, even in the first row. Abdominal uncini are borne on short, square pinnules.

The tube is composed of sand grains cemented together with mud particles.

At first it was assumed that these specimens possessing only one pair of branchiae were *P. typha* juveniles in which the second pair of branchiae was either undeveloped or had been lost. However subsequent examination revealed that the uncini of the anterior segments lacked the basal shafts found in *P. typha*, and also some of the specimens contain coelomic oocytes, apparently approaching a mature condition.

In having only one pair of branchiae, *P. dibranchis* resembles *P. vinogradovi* Uschakov but lacks the transverse dorsal membrane between the branchial stalks that is present in the latter species. According to Uschakov (1955), *P. cristata* (Müller) may also have one pair of branchiae but this species differs in possessing shafted uncini. In terms of the structure of the branchial apparatus, *P. dibranchis* is intermediate between *P. unibranchia* Day, which has a single branchia, and *P. typha* Grube, which has two pairs, all three species having branchiae with spirally arranged, or whorled, filaments.

HABITAT. A wide variety of deposits, silty mud to coarse sand and shell gravel, from MTL to 24 m depth.

RECORDS. Haroro – 1; Tetel Is. – 4 (including holotype); Graham Pt. – 1; Fintry Pt. – 3; ML 38 – 1; ML 204 – 1; ML 230 – 1; ML 283 – 6; ML 296 – 1.

British Museum (Natural History) Registration No. Holotype 1970·79
Paratypes 1970·80–89

NOTE. The habitat of *P. dibranchis* overlaps that of *P. typha*; on Tetel Island the two species were taken from the same silty mud deposit on the reef platform at about MTL.

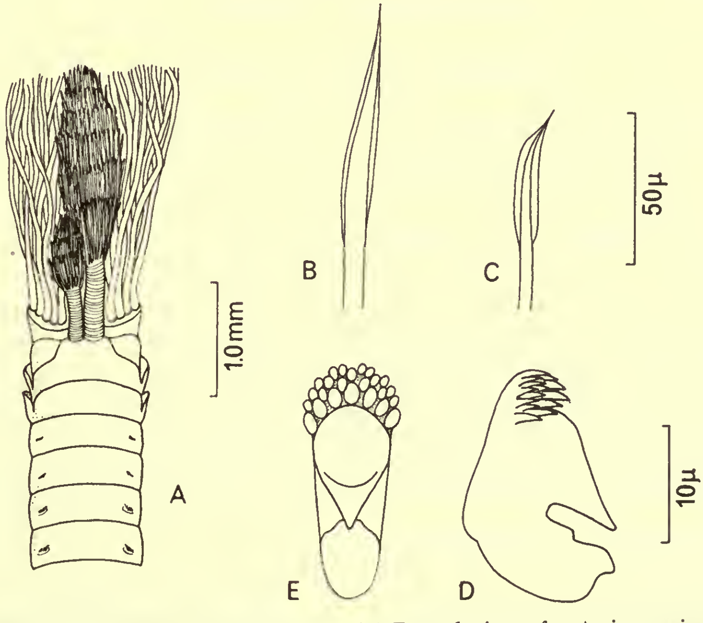

FIG. 17. *Pista dibranchis* n.sp. (A) Dorsal view of anterior region. (B–C) Thoracic notosetae. (D–E) Profile and face views of uncinus.

Pista typha (Grube, 1878)

Terebella (*Pista*) *typha* Grube, 1878 : 232, pl. 12, fig. 4.
Pista typha: Fauvel, 1953 : 424, fig. 222. a-c.

HABITAT. Silty sand and mud, MTL to LWM.

RECORDS. Tetel Is. – 23; Fintry Pt. – 1.

DISTRIBUTION. Indo-west-Pacific.

Reteterebella queenslandia Hartman, 1963

Reteterebella queenslandia Hartman, 1963 : 355, figs 1-3.

HABITAT. *Acropora* rubble at LWM.

RECORDS. Tetel Is. – 1; Maraunibina Is. – 1.

NOTES. The genus *Reteterebella* Hartman differs from the closely allied genus *Eupolymnia* Verrill in lacking notosetae on segment 4, thus having 16 instead of 17 thoracic setigers, and also in the first appearance of the double rows of uncini on the sixth (segment 10 or setiger 6), not the seventh uncinigerous segment (= setiger 8 in *Eupolymnia*).

DISTRIBUTION. North-east Australia (Queensland).

Terebella ehrenbergi Grube, 1870

Terebella ehrenbergi: Fauvel, 1953 : 421, fig. 220. a-c; Day, 1967 : 748, fig. 36.10. g-i.

HABITAT. Crevices in reef platform.

RECORDS. Matiu Is. – 2.

DISTRIBUTION. Tropical Indo-west-Pacific.

Family **SABELLIDAE**

Branchiomma cingulata (Grube, 1870)

Dasychone cingulata: Willey, 1905 : 308, pl. 7, figs 170–173; Fauvel, 1953 : 442, fig. 234. f-h.
Branchiomma cingulata: Johansson, 1927 : 161, text-fig. 14.1–2; Imajima & Hartman, 1964 : 355.

HABITAT. Embedded in *Acropora* at LWM.

RECORD. Tetel Is. – 1.

NOTES. The specimen is small, about 7 mm long. It has six radioles on each side of the branchial crown and the thoracic region consists of five segments.

Specimens from Ceylon and Japan have a greater number of radioles and eight thoracic segments but are larger-sized, which may account for these differences.

DISTRIBUTION. Indo-Pacific.

Hypsicomus phaeotaenia (Schmarda, 1861)

Hypsicomus phaeotaenia: Fauvel, 1953 : 447, fig. 236. a-l; Day, 1967 : 761, fig. 37.2. i-n.

HABITAT. Embedded (boring?) in coral, especially *Porites*, and in beachrock.

RECORDS. Kokomtambu Is. – 1; Tetel Is. – 4; Komimbo Bay – 3; Mamara Pt. – 1; Matiu Is. – 5; Paleki Is. – 1; Lauvie Is. – 7; Graham Pt. – 3.

DISTRIBUTION. Western Africa; Mediterranean; Indo-west-Pacific.

Megalomma intermedium (Beddard, 1888)

Branchiomma intermedium Beddard, 1888 : 261, pl. 21, figs 4–7; Fauvel, 1953 : 444, fig. 234. e.
Megalomma intermedium: Pillai, 1965 : 164.

HABITAT. Embedded in *Porites* boulder towards LWM.

RECORD. Tetel Is. – 1.

DISTRIBUTION. Mergui Archipelago; Philippine Islands.

Megalomma linaresi (Rioja, 1918)

Branchiomma linaresi: Fauvel, 1927 : 317, fig. 110. a-l.

HABITAT. Embedded in *Acropora* at LWM and at 5 m depth.

RECORDS. Tetel Is. – 1; Yandina – 1.

NOTES. The larger specimen is 45 mm long, including the branchial crown which has a length of 10 mm. There are 16 to 19 radioles on each side. The dorsal radioles carry the largest subterminal eyes, which gradually diminish in size on the lateral radioles and are absent from the ventral ones. The collar gapes widely on the dorsal side: it has lateral notches and large ventral lobes. There are 8 thoracic segments, the notosetae of which consist of narrow-winged capillaries and subspatulate setae.

M. linaresi is known from northern Spain and the Mediterranean. Despite the absence of records from the Indian Ocean, the specimens from the Solomon Islands appear to be identical.

DISTRIBUTION. North Atlantic (Spain); Mediterranean.

Megalomma quadrioculatum (Willey, 1905)

Branchiomma quadrioculatum Willey, 1905 : 307, pl. 7, figs 168–169.
Megalomma quadrioculatum: Day, 1967 : 758, fig. 37.1. h-o.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes on reef platform towards LWM; amongst serpulid tubes on undersurface of coral boulder.

RECORDS. Cape Esperance – 36; Komimbo Bay – 1.

NOTES. The specimens were removed from sandy tubes constructed amongst the sponges and other encrusting organisms around the bases of the chaetopterid tubes. The larger specimens measure 13 to 14 mm long. The thorax consists of 6 or 7 segments with notosetae of two types, namely narrow-winged capillaries and paleae. There are 6 to 9 radioles on each side of the branchial crown and, in most specimens, only the two dorsal radioles carry subterminal eyes. However, a few specimens have smaller eyes on one or two radioles besides the dorsal radioles.

The type specimen from Ceylon (23·5 mm in length) is almost twice the size of the Solomon Islands specimens and has 14 radioles per branchial lobe with subterminal eyes on the four dorsal radioles. It would seem therefore that the second (and occasionally a third) pair of eyes develops at a later stage and, until acquired, *M. quadrioculatum* bears a superficial resemblance to *M. bioculatum* (Ehlers) from which it can be distinguished by the presence of paleae in the notopodia.

DISTRIBUTION. Indian Ocean.

Megalomma trioculatum Reish, 1968

Megalomma trioculatum Reish, 1968 : 226, fig. 5. 1–10.

HABITAT. Sand, 2–9 m depth.

RECORDS. ML 96 – 1; ML 296 – 1.

NOTES. The two specimens measure 15 to 16 mm long, the branchial crown being 2·0 to 2·5 mm in length. Both have 6 thoracic setigers (instead of 8 or 9) and the collar gapes widely on the dorsal side of the first setiger instead of extending to the mid-segmental line. Otherwise they agree closely with type description.

At the bases of the two dorsal radioles, there are longitudinal streaks of an orange-brown pigment and the radioles are banded a similar colour. The subterminal eyes are brown or mauve. The tube is a fragile structure coated with sand grains.

DISTRIBUTION. Marshall Islands.

Megalomma vesiculosum (Montagu, 1815)

Branchiomma vesiculosum: Fauvel, 1927 : 315, fig. 109. a-q.
Megalomma vesiculosum: Day, 1967 : 758, fig. 37.1. p-u.

HABITAT. Muddy sand between MTL and LWM.

RECORDS. Tetel Is. – 20.

NOTES. The subterminal eyes are entire, not divided as in *M. pacificum* Johansson although the latter may be a synonym of *M. vesiculosum*, according to Mesnil & Fauvel (1939).

DISTRIBUTION. Atlantic Ocean; Mediterranean; Indian Ocean.

Potamilla ehlersi Gravier, 1906

Potamilla ehlersi Gravier, 1906a : 37; 1908 : 87, pl. 6, fig. 260–264; Fauvel, 1953 : 449, fig. 238. g-i.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes on reef platform towards LWM.

RECORD. Cape Esperance – 1.

NOTES. The specimen is 13 mm long (branchial crown = 3 mm). There are nine radioles on each branchial lobe; the dorsal ones are without eyes but these are present on the next 4 or 5 radioles. There are 11 segments in the thorax, the anterior half of which is coloured chocolate-brown on the dorsal side. The tube is membraneous, covered with sand grains, and, before dissection, its aperture was rolled, as found in *P. reniformis* (Müller) (cf. Fauvel, 1927, fig. 107 l).

DISTRIBUTION. Tropical Indo-west-Pacific.

Sabella fusca Grube, 1870

Sabella fusca: Fauvel, 1927 : 302, fig. 104. a-f; Day, 1967 : 764, fig. 37.2. t-v.

HABITAT. Beachrock.

RECORDS. Lauvie Is. – 3.

DISTRIBUTION. Mediterranean; tropical Indo-west-Pacific.

Sabella melanostigma Schmarda, 1861

Sabella melanostigma Schmarda, 1861 : 36, pl. 22, fig. 190, with text-figs; Fauvel, 1953 : 439, fig. 232. h-n.

HABITAT. Mud and silty sand, 24–33 m depth.

RECORDS. ML 100 – 1; ML 230 – 5.

NOTES. The specimens are only about 12 mm long and were extracted from narrow tubes (0·65 mm diameter) composed of mud particles. They are referred to this species because they possess the peculiar 'shovel-like' pick-axe setae. However pigment spots above the parapodia are lacking. There are 7 radioles, each with 2 or 3 pairs of eye-spots, on either branchial lobe. The ventral lobes of the collar are large and there is a wide gap between the dorsal lobes.

DISTRIBUTION. Circumtropical.

Sabellastarte sanctijosephi (Gravier, 1906)

Eurato sancti-josephi Gravier, 1906a : 42; 1908 : 105, pl. 7, figs 281–283, pl. 8, figs 284–285.
Sabellastarte indica: Fauvel, 1953 : 445, fig. 235. a-h.
Sabellastarte sanctijosephi: Day, 1967 : 771, fig. 37.5. f-i.

HABITAT. In crevices in *Porites* boulders at LWM (Gibbs, 1969, fig. 137).

RECORDS. Tetel Is. – 1; Paleki Is. – 5.

DISTRIBUTION. Western Africa; tropical Indo-west-Pacific.

Family **SERPULIDAE**

Subfamily **SERPULINAE**

Hydroides minax (Grube, 1878)

Serpula minax Grube, 1878 : 269, pl. 15, fig. 5.
Hydroides minax: Fauvel, 1953 : 460, fig. 241. f; Pillai, 1960 : 8, text-fig. 3. a-e.

HABITAT. Amongst *Phyllochaetopterus socialis* tubes at LWM.

RECORDS. Matiu Is. – 2.

NOTES. These specimens were referred to *H. monoceros* Gravier, a closely allied species, in an earlier paper (Gibbs, 1969).

DISTRIBUTION. Ceylon; Philippine Islands.

Hydroides uncinata (Philippi, 1844)

Hydroides uncinata: Fauvel, 1927 : 357, fig. 122. a-h; Day, 1967 : 805, fig. 38.4. h-i.

HABITAT. On *Acropora* at 5 m depth.

RECORD. Yandina – 1.

DISTRIBUTION. Atlantic Ocean; Mediterranean; East Africa; Japan.

Mercierella enigmatica Fauvel, 1923

Mercierella enigmatica: Fauvel, 1927 : 360, fig. 123. a-o; Day, 1967 : 812, fig. 38.5. o-s.
Neopomatus uschakovi Pillai, 1960 : 28, pl. 1, figs 1–2; text-figs 10. h, 11. a-h, 12. a-h; Straughan, 1966 : 139 (synonymy).

HABITAT. Brackish water – on stones and in sponge.

RECORDS. Komimbo Bay (freshwater creek) – num.; mouth of Lunga River at Lunga Pt. – 28.

NOTES. In a study of the brackish water serpulids along the east coast of Australia, Straughan (1966) discovered that there is a continuous cline in the characters used to separate the two genera *Mercierella* Fauvel and *Neopomatus* Pillai. The *Mercierella* form is characteristic of the southern populations around Sydney and the warm water *Neopomatus* form is typical for the Queensland populations.

The material from Guadalcanal is typical *Neopomatus* in that there are one or two rows of outwardly directed spines on the operculum, the collar and thoracic membranes are fused dorsally for up to three-quarters of the length of the thorax, and the collar setae have modified proximal teeth.

DISTRIBUTION. Cosmopolitan in estuarine water.

Serpula hartmanae Reish, 1968

Serpula hartmanae Reish, 1968 : 228, fig. 5. 11–16.

HABITAT. Attached to coral on reef platform.

RECORDS. Mamara Pt. – 1; Komimbo Bay – 3.

DISTRIBUTION. Marshall Islands.

Serpula vermicularis Linnaeus, 1767

Serpula vermicularis: Fauvel, 1927 : 351, fig. 120. a-q; 1953 : 454, fig. 239. a-q; Dew, 1959 : 22, fig. 3. a-h; Day, 1967 : 809, fig. 38.5. a-h.

HABITAT. Attached to coral boulders on reef platform.

RECORDS. Tetel Is. – 2; Komimbo Bay – 5.

DISTRIBUTION. Cosmopolitan.

Spirobranchus giganteus (Pallas, 1766)

Spirobranchus giganteus: Fauvel, 1953 : 462, fig. 242. a-g; Day, 1967 : 803, fig. 38.3. h-k.

HABITAT. Embedded in living *Porites* boulders (Gibbs, 1969, fig. 138) and encrusting on reef platform.

RECORDS. Kokomtambu Is. – 2; Tetel Is. – v. num.; Komimbo Bay – num.; Mamara Pt. – 1; Matiu Is. – 9; Paleki Is. – v. num.; Sifola – 1; Graham Pt. – num.

NOTES. This species is common in moderately sheltered conditions and the largest specimens, over 110 mm in length and 10 mm in diameter, were extracted from living *Porites* at Paleki Island. In comparison, encrusting forms on dead coral are much smaller in size.

DISTRIBUTION. West Indies; Indo-west-Pacific.

Spirobranchus coutierei (Gravier, 1908)

Pomatoceropsis coutierei Gravier, 1908 : 125, pl. 8, figs 294–299, text-figs 482–487.

HABITAT. Embedded in *Porites* towards LWM.

RECORDS. Tetel Is. – 3.

NOTES. Following Straughan's (1967) key to the Indo-west-Pacific species, this identification is based on the following two characters – (i) the operculum has three processes which are deeply divided so as to give six distinct horns, and (ii) the interbranchial membrane is fimbriated.

DISTRIBUTION. East Africa; northern Australia (Straughan, 1967*a*).

Vermiliopsis glandigerus Gravier, 1908

Vermiliopsis glandigerus Gravier, 1908 : 121, pl. 8, figs 290–291, text-figs 476–481; Fauvel, 1953 : 467, fig. 242. k; Day, 1967 : 813, fig. 38.6. g-i.

HABITAT. Encrusting on reef platform.

RECORD. Matiu Is. – 1.

DISTRIBUTION. Western and southern Africa; Indo-west-Pacific.

Subfamily **FILOGRANINAE**

Filograna implexa Berkeley, 1835

Salmacina dysteri: Fauvel, 1927 : 377, fig. 129. c-k; 1953 : 476, fig. 250. c-k; Dew, 1959 : 50, fig. 19. a-g.

Filograna implexa: Fauvel, 1927 : 376, fig. 129. a-b; Day, 1955 : 450 (synonymy); 1967 : 817, fig. 38.7. a-h.

HABITAT. Encrusting on an oyster shell attached to wharf pile.

RECORDS. Yandina – num.

NOTE. No individual with an operculum developed at the end of a branchial filament was noted amongst the colony; the specimens thus correspond to the *Salmacina* form.

DISTRIBUTION. Cosmopolitan.

ADDENDUM

Recently Professor J. E. Morton forwarded a small collection of polychaetes which he collected in the Solomon Islands during the 1965 Expedition. This material includes specimens of a further two species, bringing the total number of recorded species to 222.

The species are the following:

Family **NEREIDAE**

Perinereis neocaledonica Pruvot, 1930

Perinereis neocaledonica Pruvot, 1930 : 50, pl. 3, figs 77–79, text-fig. 4. a-c; Fauvel, 1932 : 107; 1953 : 211, fig. 108. c-g; Tampi & Rangarajan, 1964 : 106.

RECORDS. Batuona Is – 10.

DISTRIBUTION. Tropical Indo-west-Pacific.

Family **GLYCERIDAE**

Glycera subaenea Grube, 1878

Glycera subaenea Grube, 1878 : 184, pl. 8, fig. 8; Fauvel, 1919a : 425, pl. 16, figs 48–51; Hartman & Imajima, 1964 : 164; Day, 1967 : 363, fig. 16.3. k-n.

RECORDS. Komimbo Bay – 3.

DISTRIBUTION. Indo-west-Pacific.

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The Hebrew University of Jerusalem

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SYNOPSIS

A report on 45 lizards and snakes, representing 23 species and subspecies, collected in northern and southwestern Transjordan, mostly during 1963–1965. Taxonomic characters are presented, and compared with data from adjacent areas, mainly Cisjordan. Relevant Transjordanian specimens in the Hebrew University of Jerusalem are also considered, and some identifications are revised. Field observations are cited. *Agama pallida haasi* ssp. nov. is described (type: BM 1965.800; 18 paratypes in BM, HUJ, FMNH). The only additions, on the species level, to the Transjordanian fauna, are *Coluber rhodorhachis* Jan and *Malpolon moilensis* Reuss. The ecological and phytogeographical subdivision of Transjordan into Mediterranean, Irano-Turanian, and Saharo-Sindian territories is reviewed. The distribution of reptiles appears to accord with this subdivision. The difference between the herpetofaunas of Trans- and Cisjordan, on the specific and subspecific levels, is greater in the south than in the north. Notably 7 Irano-Turanian and Saharo-Sindian forms of Transjordan do not occur in Cisjordan. It is suggested that the Wadi 'Arava together with the steep mountains bordering it on the east, may constitute a barrier to the distribution of reptiles.

INTRODUCTION

TRANSJORDAN, or Eastern Palestine, is of great zoo-geographical interest. In the north-west it borders on the mesic (Mediterranean) regions of Cisjordan (or Western Palestine), and Syria. To the north and north-east its steppe is continuous with the steppes of Syria and Iraq, while its south-eastern portions are part of the Arabian desert. In the south-west, along the Wadi ʻArava, Transjordan adjoins the arid south of Cisjordan (Negev of Isreal), which, through Sinai, affords communication with north-eastern Africa.

Despite the efforts of numerous naturalists, zoologists and herpetologists, the herpetofauna of this whole region remains imperfectly known. The best-known territory is the part of Cisjordan which has been within Israel since 1948, although the latest review of its herpetofauna in a European language (Haas, 1951) is now outdated due to subsequent collecting. More recent information is available to readers of Hebrew (Barash and Hoofien, 1956; Wahrman, 1963; Y. L. Werner, 1966). The herpetofauna of Sinai was reviewed by Schmidt and Marx (1956) and Marx (1968), and that of Iraq by Khalaf (1959). The herpetofauna of Syria and Lebanon was the subject of several older reports (referred to by Flower, 1933; Schmidt, 1939; Haas, 1951), and one recent publication (Zinner, 1967).

The least known territory, herpetologically, is Transjordan, where little collecting has been done. Apparently the only recent papers dealing specifically with the herpetofauna of this area are those of Schmidt (1930), Parker (1935), Haas (1943, 1951), Hoofien (1965, 1969) and Werner (1968). A few reports of broader scope also deal with Transjordanian reptiles; notably those of Peracca (1894), Barbour (1914), Schmidt (1939) and Wettstein (1951), and those cited by these authors or by Parker (1935) and Haas (1943, 1951).

Recently the British Museum (Natural History) obtained 39 specimens of lizards, and 6 of snakes, from Transjordan, thanks to the thoughtfulness of three parties whose primary object had not been the collection of preserved reptiles: Mr. S. Bisserôt of the British Jordan Expeditions 1963 and 1965 (Mountfort, 1965), Mr. D. Western of the University of Leicester, and (one specimen) Mr. W. Larmuth. The present material makes a notable addition to our knowledge of the reptiles of Transjordan and their distribution.

In this paper all but one of these new specimens* are described and discussed with a view to stimulating the interest of herpetologists in this little-known region. Comparisons are made with specimens previously collected in Transjordan by Prof. G. Haas, Prof. H. Mendelssohn and Mr. J. H. Hoofien (Haas, 1943, 1951; Hoofien, 1957) and deposited at the Hebrew University of Jerusalem, and with series from Cisjordan in the same collection. The zoogeographical implications of the limited data available are discussed.

LOCALITIES

The localities are indicated by numbers in text-figures 1 and 2, as follows:

1. Jordanian–Syrian border, Jerusalem–Damascus road.
2. Tell el Mukheizin.
3. Ain el Enoquiya.
4. Azraq Druz.
5. Wadi Ratam.
6. El Azraq.
7. Wadi Aseikhim.
8. Azraq Shishan.
9. Jebel Uweinid.

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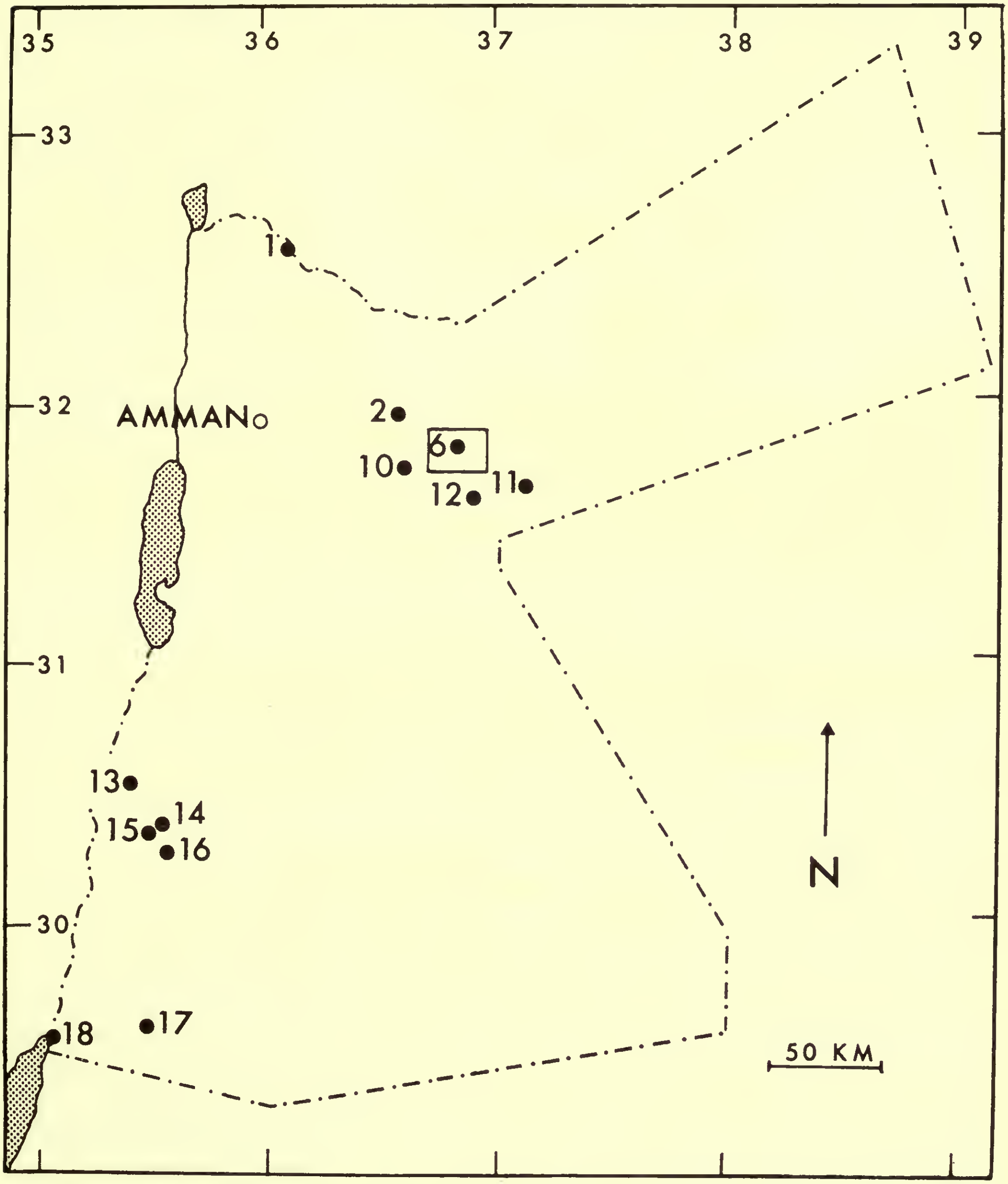
*A specimen of *Stenodactylus grandiceps* Haas, ♂, BM 1963.665, collected by S. Bisserôt at the Azraq Oasis (in a sandy area), was received by the British Museum but not examined by the author.

10. Qasr Amra.
11. Tell Qarma.
12. Qa el Umari.
13. Shaubak.
14. Wadi Musa.
15. Petra.
16. Basta.
17. Rum.
18. Aqaba.


35
36
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33
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31
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AMMAN
1
2
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10
11
12
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16
17
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N
50 KM

FIG. 1. Localities from which material is reported here. The rectangle around 6 is enlarged in fig. 2. Locality names in text. (Political frontiers as before 1966.)

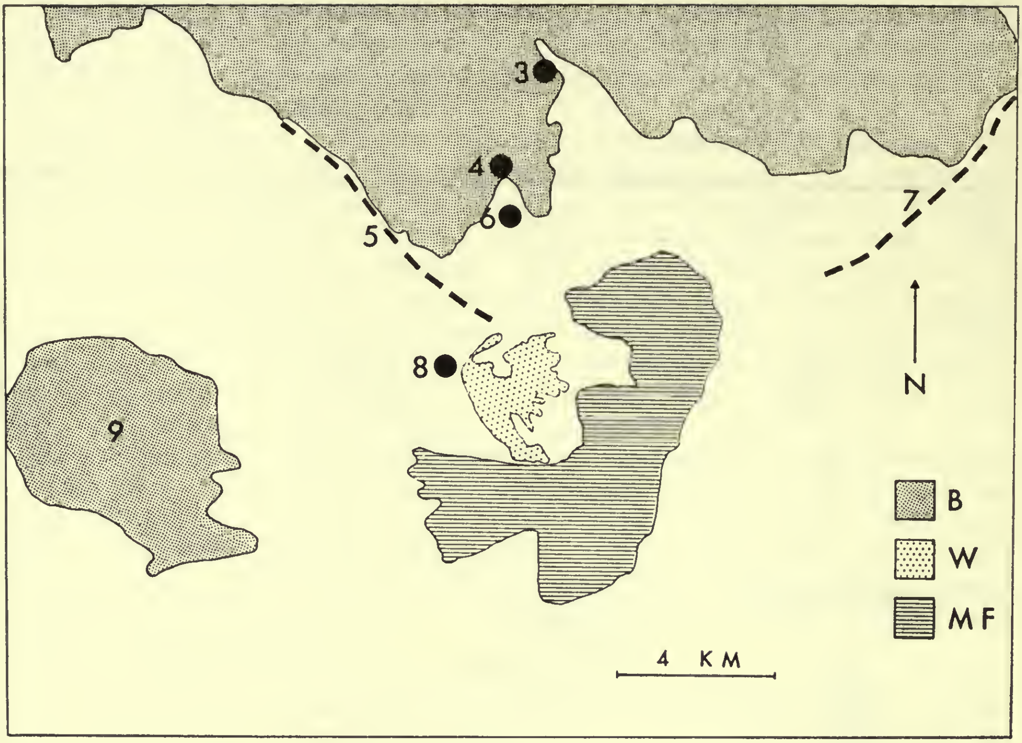

FIG. 2. Localities near Azraq from which material is reported here. This area corresponds to the rectangle around 6 in fig. 1. Locality names in text. B, Basalt areas; W, Water; MF, Mud flats.

METHODS

Abbreviations:

BM—British Museum (Natural History), London.
FMNH—Field Museum of Natural History, Chicago.
HUJ-R—Herpetological Collection, The Hebrew University of Jerusalem.
SMF—Senckenberg Museum, Frankfurt.
SV—Snout-vent length.
%SV—Percentage of snout-vent length.

Measurements: SV length is from the tip of the snout to the anterior margin of the cloaca. Measurements of parts of the body are preferably expressed in %SV (see abbreviations, also Werner, 1969) rather than in absolute values. In *Agama pallida, head length to occiput* is from the tip of the snout to the palpated occipito-atlantal articulation, in a straight line (with dividers); and *head length, total* is from the tip of the snout to the rear of the angle of the jaws, parallel to the long axis of the animal. The *head index* is derived from the formula 100 × "Head length, total"/"Head width".

In the case of *Agama pallida*, the *statistical significance* of differences in numerical values between sample pairs was tested in the following manner: 1. The significance ($\alpha = 0{\cdot}05$) of the difference between the variances of the two samples was checked, using the F-distribution. 2. Regardless of the result, the statistic t (Winer, 1962 : 28) was computed, and used in Student's t-test (Winer, 1962: 28-29) as follows: 3. First, t was assigned $n_a + n_b - 2$ degrees of freedom; all cases in which sample means did not differ significantly, needed no further consideration. 4. Where sample means differed significantly ($\alpha = 0{\cdot}05$), and the variance had not differed significantly, the result was accepted. 5. Where the means differed significantly, but the variances had also differed significantly, the significance of the difference between the means was confirmed by assigning to t only the degrees of freedom of the smaller of the two samples, making use of Welch's approximation (Winer, 1962 : 37–38) to the t' distribution,

$$t' = \frac{(\overline{X}_a - \overline{X}_b) - (\mu_a - \mu_b).}{\sqrt{(s_a^2/n_a) + (s_b^2/n_b)}}$$

Field notes are credited expressly to the observer (collector) except where the observed animal is cited by its number, whereby the collector's name can be located in 'Material Examined'.

Other terms and procedures are as explained by Haas and Werner (1969), else as defined by H. M. Smith (1946 : 17–30) or as presented by Peters (1964).

LACERTILIA

GEKKONIDAE

Hemidactylus turcicus turcicus Linnaeus

Lacerta turcica Linné, 1758. Syst. Nat., ed. 10, 1, p. 202 (Orient).
Hemidactylus turcius, Boettger, 1876. Ber. offenbach. ver. Naturk., 15/16 : 57.
Hemidactylus turcicus turcicus, Mertens, 1925. Abh. senckenberg. naturf. Ges., Frankfurt a.M., 39 : 60.

Material examined (1). BM 1965.683 ♀, [between Azraq Shishan and Azraq Druze],* April–May 1965, S. Bisserôt.

Pholidosis. Dorsal tubercles keeled, 14 in a diagonal row across the back. Usually 2–3 granules between successive or adjacent tubercles. Counts of scansors are presented in Table 1.

Measurements. SV: 47 mm; tail incomplete.

Coloration. Dorsum with five semi-regular longitudinal rows of brown markings of irregular shape.

Field notes. "The only other gecko found was the Turkish Gecko (*Hemidactylus turcicus*) [one of] which was found in a damaged condition on the track between Azraq Shishan and Azraq Druze" (S. Bisserôt).

Remarks. Five specimens previously collected in Transjordan were available for comparison (HUJ-R 1063 70 km S. of Amman: Sisah-Chissa, 27 March 1936,

*Not indicated on the specimen label, but derived from Mr. Bisserôt's field notes.

Haas; HUJ-R 1064 Hissa-Ma'an, 28 March 1936, Haas; HUJ-R 1068 Wadi Daba'a SSE of Amman, July 1938, Haas; HUJ-R 1587 Jerash, 18 November 1945, Haas and Hoofien; HUJ-R 1588 Birketen-Jerash, 16 November 1945, Haas and Hoofien). Of these, four likewise have 14 rows of tubercles, but one has 12. Scansor counts for these specimens are included in Table 1 and compared to Boulenger's (1885) data for *H. turcicus* and *H. sinaitus*. The specimens from Transjordan, including those from the desert, are typical *H. turcicus*.

TABLE 1

Scansor counts for *Hemidactylus turcicus* from Transjordan, compared to Boulenger's (1885) counts for *H. turcicus* and *H. sinaitus*. (N, number of specimens.)

Locality (and repository of material.)		Scansors (single or paired) under:-			
		Fingers		Toes	
	N	First	Fourth	First	Fourth
Azraq area (BM)	1	7	9	7	12
Jerash area (HUJ)	2	6–7	8	6	9–10
Southern Transjordan (HUJ)	3	7–8	8–9	6–7	10–12
Transjordan, cumulative	6	6–8	8–9	6–7	9–12
Boulenger's *H. turcicus*	28	6–8	8–10	6–8	9–11
Boulenger's *H. sinaitus*	1	5	7	5	8

A pattern of dark (brown) spots arranged in 6–8 longitudinal rows occurs in HUJ-R 1587–8 and, to a lesser extent, HUJ-R 1064. None show a pattern of crossbands or of large X-shaped designs (each stretched across the back), whereas these are often encountered in specimens from Cisjordan, the latter pattern being particularly common in certain localities (*e.g.* En Gedi).

Ptyodactylus hasselquistii cf. *guttatus* von Heyden

Ptyodactylus guttatus von Heyden, 1827, in Rüppell, Atlas Reise nordl. Afrika, 1. Zool.: Reptilien, p. 13, pl. 4, fig. 1 (Tor, Sinai).

Ptyodactylus hasselquistii Phalanx *guttata* (part), Anderson, 1898. Zoology of Egypt, 1. Reptilia and Batrachia, London, pp. 65–67, pl. 6, figs 4, 5 and 5a, pl. 7, figs 6 and 7.

Ptyodactylus hasselquistii guttatus, Barash and Hoofien, 1956. Reptiles of Israel, Tel-Aviv, p. 161.

MATERIAL EXAMINED (4). BM 1963.664 ♀ Rum (rocky area), 1963, S. Bisserôt. BM 1965.782 juv. Petra (on red sandstone), 2 August 1965, D. Western. BM 1965.783 and 1965.784 juvs. Wadi Musa (under yellow sandstone rock), 4 August 1965 (3.30 pm and 12.30 pm resp.), D. Western.

PHOLIDOSIS. Tubercles of the three juveniles flat-conical, with indications of keels; of the adult, distinctly keeled. Hardly any tubercles in front of the ear or on the forearm. Other details in Table 2 ("Petra-Rum") which may be compared with Loveridge's table (1947 : 279).

MEASUREMENTS. Adult: SV: 68 mm; tail missing. Juveniles: SV: 55, 31 and 30 mm resp.; only the last with complete (?) tail: 23 mm.

TABLE 2

Pholidosis and measurements of 12 *Ptyodactylus hasselquistii* sspp. from Transjordan, for comparison with Loveridge's (1947 : 279) table.

Locality (and repository of the material)	Number of Specimens	Internasal Granules	Nasals Surrounding Nostril	Upper Labials	Lower Labials	Tubercle Rows on Dorsum	Scansors under First Toe	Scansors under Fourth Toe	Tubercle Rows on Tail	Greatest Length from Snout to Vent, mm	Greatest Length of Tail, mm
Petra – Rum (BM)	4	1	3–4[1]	11–14	11–13[2]	12–13	3–4	9–11	4–6	68	?
S of Guveira (HUJ)	1	1	3	14	11–12	12	2–3	12	6	62·5	54
Basalt Desert (BM)	1	1	3	12–13	10	10	2	9	6	41	38·5
Jerash area (HUJ)	6	1	3	10–12	8–10	12	2–5[3]	9–11[4]	6–7	67	52

[1] Four were observed on only one side of one specimen (BM 1965.784).

[2] But 15 were counted on one side of one specimen (BM 1963.644).

[3] Each of the extreme counts (2 and 5) occurred on only one side of one animal; in all other cases there were 3–4 scansors under the 1st toe.

[4] The count is uncertain on one side of HUJ-R 1653 (? 7–9).

COLORATION. Collector's notes: BM 1965.782, "grey with green and brown spots, light orange mottling". BM 1965.783 and 1965.784, "beige with brown and white spots". After preservation these three juveniles from near Petra are a light greyish brown, with small light spots which are nearly round, and are 3–6 granules across. They are arranged fairly regularly in longitudinal rows; dark brown spots of less regular shape are arranged between them. The adult from Rum (BM 1963.664) is coloured similarly, but the light spots are only faintly discernible, and the dark spots are larger, of more irregular shape, and less regularly scattered. All specimens have whitish underparts.

REMARKS. *Ptyodactylus hasselquistii* is notorious for its high geographical variability (Flower, 1933; Loveridge, 1947; Werner, 1965). This is particularly true in the regions surrounding the Gulf of Suez, Gulf of 'Aqaba, and the Dead Sea, where the typical form meets, mixes, or intergrades with *guttatus*. The present series shows points of resemblance to *guttatus* from (central) Israel, and to the original illustration of von Heyden; but on the basis of our single adult without tail, allocation remains uncertain.

One subadult from S of Guveira (HUJ-R 1027, 28 March 1936, Haas) resembles the present specimens in its keeled dorsal tubercles and in lacking tubercles in front of the ear and on the forearm. Its particulars are included in Table 2.

Ptyodactylus hasselquistii puiseuxi Boutan

Ptyodactylus puiseuxi Boutan, 1893. Rev. Biol. du Nord de la France, 5 (9) : 27–32, pl. 3, fig. 4 ("Bords du lac de Houleh").

Ptyodactylus lobatus syriacus, Peracca 1894. Boll. Mus. Zool. Anat. comp. Torino, 9 (167) : 1–6 (Jerash, Transjordan).

Ptyodactylus hasselquistii puisieuxi, Haas, 1951. Bull. Research Counc. of Israel, 1 (3) : 95.

Ptyodactylus hasselquistii puiseuxi, Barash and Hoofien, 1956. Reptiles of Israel, pp. 160–161.

MATERIAL EXAMINED (1). BM 1965.682 juv. Basalt desert, Wadi Aseikhim, April–May 1965, S. Bisserôt.

PHOLIDOSIS AND MEASUREMENTS. Tubercles not keeled, each resembling a low cone. Between ear and corner of mouth 10–15 tubercles, and on each forearm about 15. Other details in Table 2 ("basalt desert") which may be compared with Loveridge's table (1947 : 279).

COLORATION. After preservation, dark brownish grey with round whitish dots (2–3 granules in diameter) alternating with roundish dark spots (5–8 granules in diameter). Underparts light grey. Tail with conspicuous alternating dark and light half rings on the dorsal surface; ventral surface is grey with whitish mottling.

FIELD NOTES. " . . . the fan-footed gecko (*Ptyodactylus hasselquistii*) . . . greater quantities were found when they eventually were observed for the first time on April 30th 1965, always on the basalt. One clutch of eleven eggs [obviously at least 5½ clutches] of this species was found at Wadi Aseikhim, nine of which were hatched and two not. One captive specimen laid two eggs during the journey back . . . " (S. Bisserôt).

REMARKS. The same subspecies occurs at and around Jerash (*terra typica*, Peracca, 1894) as also shown by 6 specimens collected by Haas and Hoofien in 1945 (HUJ-R 1651–5 and 6112). Particulars of these are included in Table 2. The present specimen, closely resembling *puiseuxi* from Jerash and from northernmost Cisjordan, allows us to suggest that *puiseuxi* is probably primarily associated with basalt rocks, regardless of whether these are in a mesic habitat (northern Cisjordan and northwestern Transjordan) or in an arid one (basalt desert of northeastern Transjordan). It is not, however, absolutely restricted to basalt, occurring also on adjacent calcareous formations.

AGAMIDAE

Agama pallida haasi subsp. nov.

(Text-fig. 3; Pls 1, 2)

Agama ruderata pallida (part), Haas, 1943. Copeia 1 : 12.

Agama pallida (part), Haas, 1951. Bull. Res. Counc. Israel 1 (3) : 72–74.

HOLOTYPE. BM 1965.800 ♂ Azraq in Transjordan, 12 August 1965, D. Western.

PARATYPES (18). Males (10): BM 1965.684 Jebel Uweinid (Basalt desert), April–May 1965, S. Bisserôt; BM 1965.796 Azraq, 12 August 1965, D. Western; HUJ-R 1117 between Sisah and Ma'an, March 1936, G. Haas; HUJ-R 1121 N. Dahaa, 65 m

SSE Amman, June–July 1938, collector unknown; HUJ-R 1134 between Hissa and Amman, 28 March 1936, G. Haas; HUJ-R 5215, 5216 and 5217 between Sisah and Ma'an, March 1936, G. Haas; HUJ-R 1227 near Palmyra, Syria, June 1944, Theodor; FMNH 48468 Wadi Dabaa 65 m SSE Amman, July 1938, collector unknown (from Hebrew University). Females (4): HUJ-R 1118 between Hissa and Ma'an, nr. Ma'an, 28 March 1936, G. Haas; HUJ-R 1120 60 km NE Zerka, Transjordan (no date), Sjoma Graber; HUJ-R 1124 about 12 km S of Amman, 26 March 1963 (?) Mendelssohn; HUJ-R 1884, Wadi Debba, Transjordan, Summer 1939, collector unknown. Juveniles (4): BM 1936.666 Azraq, 16 April 1963, S. Bisserôt; BM 1965.797, 1965.798 and 1965.799 Azraq, 12–13 August 1965, D. Western.

DIAGNOSIS. Ear opening distinctly longer than high, bordered above by a row of conspicuous spines; not round with fairly smooth margin as in *Agama pallida pallida* Reuss 1833 from eastern Egypt, Sinai, and southern Israel. Total size larger, head and body more elongate than in *A. p. pallida.* Ventral scales usually smooth, not keeled as in *Agama agnetae* F. Werner 1939 from western Iraq. (Pls 1 & 2).

DESCRIPTION OF HOLOTYPE. A male. Head very convex, short and thick, but distinctly longer than broad (head index:114). Nostril not tubular, superior, barely above the indistinct canthus rostralis. Nasal shield flat. Upper head scales convex, with short terminal keels; occipital not enlarged. No well-developed spines on the hinder part of the head, but a few occipital scales are pointed (resembling the enlarged scales scattered on the back). A fringe of 3–4 distinct spines on the upper edge of the ear, pointing downwards (in the preserved specimen), except for one spine, on the anterior margin of one ear, which points backwards. Ear opening smaller than eye opening, elongate, nearly twice as long as high; its upper (spiny) border nearly straight and horizontal (Pl. 1 B). No gular pouch. Body depressed, not as short as in *A. pallida pallida* (Pls 1 A; 2 A). Dorsal scales very small, irregular, faintly imbricate, indistinctly keeled; intermixed with scattered larger scales each of which bears a short keel, sometimes ending in a short spine. Scalation of limbs, and proximal quarter of tail, similar to that of back, but the small ground scales larger than on back. Ventral scales smooth, imbricate. Tibia longer than the skull (to occiput). Third finger shorter than fourth, fifth not extending as far as second; third toe much shorter than fourth, fifth not extending as far as first. Tail 145% SV long (somewhat more than twice as long as the distance from gular fold

MEASUREMENTS OF HOLOTYPE.	mm
Total length	189
Snout-vent	77
Head length (to occiput)	20
Head length (total)	24
Width of head	21
Body (occiput-vent)	57
Forelimb	40
Hindlimb	59
Tail	112

to vent), circular in cross section, its distal three quarters with subequal keeled scales. A double row of 'anal pores' (10 + 12).

Coloration of holotype. Collector's note: "mottled dark grey brown: white dashes". After preservation, brownish grey. Pileus yellowish. In the orbital area, below the eye, six faint grey radiating streaks; side of head otherwise plain. Dorsum with four darker brown crossbands, each interrupted by an irregular whitish vertebral streak. First crossband in front of, second behind, shoulder. Third, indistinct. Fourth just in front of pelvis. Thirteen uninterrupted crossbands on tail. The first two are similar in colour to the ones on the body, the remainder are paler. Underparts light cream, throat mottled with 8–10 grey wavy longitudinal bands.

Variation of the type series. Females have no anal pores, and their heads are shorter (relative to SV length) than in males. The largest specimen is a female (HUJ-R 1118), SV 93·5 mm; largest male (HUJ-R 1117) SV 89 mm. At the upper border of the ear there are 2–4 large and 0–2 small spines; the commonest arrangement is 3 large and 1 small spine. All juveniles, including the smallest (SV: 33 mm), show the distinctive ear features of the new form, except that the enlarged scales bordering the ear opening dorsally are not spiny (Pl. 1 C–D). The ventral scales are moderately keeled on the posterior abdomen of one specimen (HUJ-R 1134). The variations of pholidosis, measurements and proportions, and pattern, and comparable variations of *A. p. pallida* from southern Cisjordan are summarized in Table 3. Differences between the samples from Transjordan and Cisjordan (comparisons being made separately among males, females and juveniles), were statistically significant only in the following instances: Among males, the two samples differed significantly in SV length ($t = 6{\cdot}32$; $t_{10\ (\cdot 05)} = 2{\cdot}23$); in head length (to occiput) in %SV ($t = 2{\cdot}59$; $t_{9\ (\cdot 05)} = 2{\cdot}26$); in head width in %SV ($t = 4{\cdot}53$; $t_{28\ (\cdot 05)} = 2{\cdot}05$); and in the head index ($t = 3{\cdot}52$; $t_{28\ (\cdot 05)} = 2{\cdot}05$). Among females the two samples differed only in head width in %SV ($t = 3{\cdot}18$; $t_{21\ (\cdot 05)} = 2{\cdot}08$) and in the head index ($t = 2{\cdot}13$; $t_{21\ (\cdot 05)} = 2{\cdot}08$).

Collector's note on coloration: "The Pale Agamid (*Agama pallida*) varied considerably, in colour and markings . . .. *A. pallida* showed no colour changes under any circumstances". (S. Bisserôt.)

Field notes. "Three species of . . . Agamidae were seen and collected . . .. *A. pallida* was the most common but was found only on the hamada. . . . On the hamada areas the dominant reptiles appeared to be . . . and Agama pallida . . . " (S. Bisserôt). Two of the adult males (BM 1965.800 and 1965.796) were caught "among small rough stones: flint, basalt and chert on brown silty matrix between stones" (the first at 11.30 h). A juvenile, BM 1965.798 "in shade under Holoxocum silicanum [? *Haloxylon salicornicum*] near black basalt rocks (12.30 pm)"; another juvenile, BM 1965.797, "on flint stone desert", and another among "basalt outcrops—large basalt boulders with white interdispersed silt under rock". HUJ-R 1134 was caught on "Ebene Stein Wüste" (even stone desert).

"The Pale Agamid . . . appeared to rely on three methods of escape, firstly by quick bursts of running when the body was held high off the ground and the head up, than by flattening the body to the ground and remaining motionless, relying on camouflage, and lastly by an aggressive stance with mouth open always facing the attacker." (S. Bisserôt.)

GROWTH. The three juveniles collected on 12–13 August 1965 by Mr. Western measure 44, 38·5 and 33 mm respectively (SV). These obviously had hatched earlier in the same season. The one taken on 16 April 1963 by Mr. Bisserôt measures (SV) 46·5 mm and evidently had hatched in the previous summer. The 17 specimens for which the date (at least the month) of collection is known (Text-fig. 3) make it probable that in Transjordan the hatchlings of the year reach ca. 40–50 mm (SV) by autumn, grow to ca. 70–80 mm during the following year, and attain 80–90 mm in their third warm season.

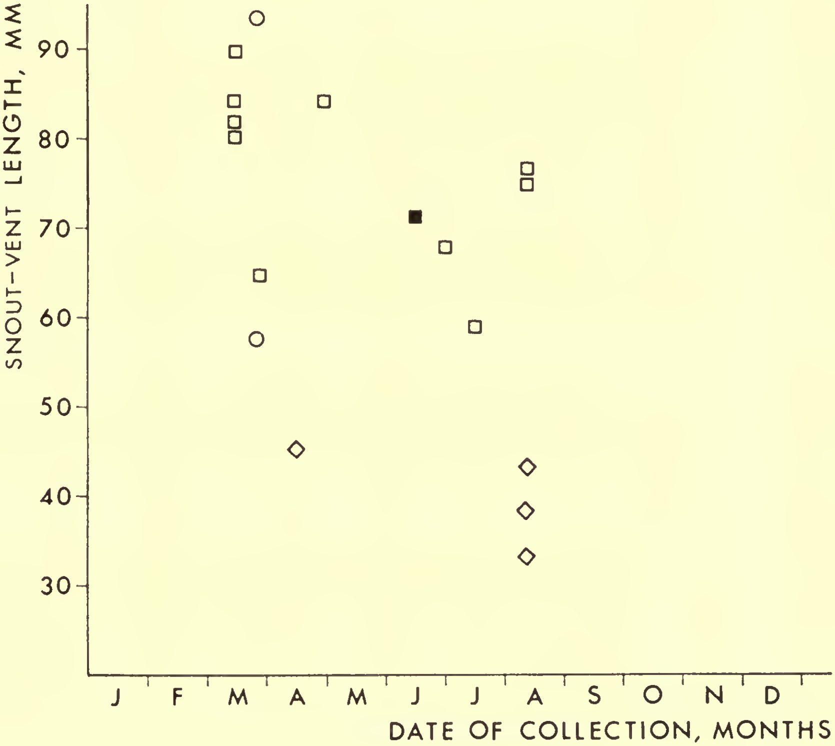

FIG. 3. *Agama pallida haasi* subsp. nov. Sizes of animals caught at different times of the year. Squares, males; Circles, females; Diamonds, juveniles. Open symbols, animals from Transjordan; Solid symbol, animal from near Palmyra, Syria.

REMARKS. It is a pleasure to name this lizard in honour of Professor Georg Haas who had already commented on its relatively large size (1951). The new taxon is most closely allied to *Agama pallida* Reuss 1833 from Eastern Egypt, Sinai and Southern Cisjordan. In Reuss' original description there is no indication of the type locality, except that the whole material under discussion had been collected by

TABLE 3

Variation in measurements and proportions, femoral pore counts, and pattern, in *Agama pallida* subspp. from Cisjordan and Transjordan, compared to Reuss' type. (N = number of specimens, OR = observed range, M = mean, SD = standard deviation; SV = snout-vent length, %SV = percents of SV.)

Character		Reuss' type ♀	Cisjordan			Transjordan		
			Males	Females	Juveniles	Males	Females	Juveniles
SV length in mm	N		20	20	20	11	3	5
	OR	81·77	55–67	55–81	29–50	59–89	58·5–93·5	33–50
	M		61·2	67·0	42·5	75·8	77	42·4
Head length, to occiput, % SV	N		20	20	20	10	3	5
	OR	(?)	22·7–27·3	17·1–25·5	21·1–29·5	23·6–30·9	20·9–26·5	25·0–30·3
	M		24·9	23·2	26·4	26·6	23·4	27·4
	SD		1·1	1·7	1·8	2·5	2·9	2·1
Head length, total, % SV	N		20	20	20	10	3	5
	OR	32·0	25·0–32·8	24·7–36·7	26·1–33·0	27·4–31·4	25·7–28·2	31·2–34·0
	M	?	29·5	28·3	29·5	29·7	27·2	32·3
	SD		1·8	2·4	1·7	1·3	1·4	1·3
Head width, % SV	N		20	20	20	10	3	5
	OR	24·7	25·4–29·5	24·1–29·7	26·1–31·0	23·8–28·5	21·9–25·6	26·1–36·0
	M		27·8	27·0	28·6	26·0	23·9	29·3
	SD		1·2	1·5	1·3	1·6	1·9	4·0
Forelimb, % SV	N		20	20	20	11	3	5
	OR	42·7	42·2–54·1	38·8–52·7	41·3–57·9	44·9–61·0	43·9–50·6	49·4–57·6
	M		48·8	46·6	50·9	50·6	48·3	52·3
	SD		3·1	3·2	3·5	4·0	3·9	3·4
Hindlimb, % SV	N		20	20	20	11	3	5
	OR	62·7	68·2–80·3	62·1–80·0	58·7–82·8	65·7–90·0	62·0–76·9	72·7–81·7
	M		72·7	69·2	75·4	74·2	70·0	76·5
	SD		3·1	4·9	5·1	6·3	7·5	3·6

Tail, % SV	N		18	17	19	9	3	5
	OR	86·7	119·3–143·1	93·3–140·0	115·8–144·4	123·1–159·3	103·7–145·3	122·0–132·5
	M		134·2	116·9	129·5	136·3	121·8	127·9
	SD		5·3	11·2	7·7	11·1	21·3	4·4
Head index (100 × head length, total ÷ head width)	N		20	20	20	10	3	5
	OR	129·7	94·1–117·7	93·8–125·7	88·9–115·4	102·7–125·6	110·0–117·1	94·4–121·7
	M	(?)	106·2	105·1	103·2	114·8	114·3	111·3
	SD		5·7	7·0	6·3	7·3	3·0	10·3
100 × hind-limb ÷ forelimb	N		20	20	20	11	3	5
	OR	147·5	137·5–173·1	136·7–164·5	142·1–157·1	138·5–155·0	140·0–152·5	136·8–152·6
	M		149·2	148·7	149·9	146·5	144·7	147·2
	SD		8·0	6·4	4·5	4·2	6·9	6·5
Total number of anal pores	N		19	3[1]	5[2]	11		
	OR	(none)	18–33	11–21	15–20	19–31	(none)	(none or uncertain)
	M		25·0	17·3	17·2	23·8		
	SD		4·0	5·5	2·6	3·3		
Number of rows of anal pores	N		19	3[1]	5[2]	11		
	OR	(none)	2–3	1–2	2	2–3	(none)	(none or uncertain)
	M		2·2	1·7	2	2·3		
	SD		0·4	0·6	0	0·5		
Number of crossbands on tail	N		19	17	16	8	2	5
	OR	9	11–17	7–17	9–17	12–15	12–13	11–14
	M		13·6	12·6	12·6	13·4	12·5	12·5
	SD		1·8	2·3	2·0	0·9	0·7	1·2

[1] Sixteen additional females had no anal pores.

[2] Fifteen additional juveniles had no anal pores.

Rüppell. Reuss' original specimen label indicates "Aegypt, super." (Klemmer, 1967). The species, however, does not seem to occur in Upper Egypt, and Anderson (1896 : 79) gives "Sinai" as the type locality (see also Flower, 1933). Through the courtesy of Dr. Klemmer I could examine excellent photographs of the type (SMF 10007) and satisfy myself that material from southern Cisjordan and eastern Egypt (Kassassin) is in good general agreement with it. Reuss' description includes no scale counts, but some of his many measurements are represented in Table 3.

The new form is so far known from central and northern Transjordan and SE Syria, but specimens from the rest of Syria and from Iraq will probably also be found to belong to this form. *A. p. pallida* Reuss and *A. p. haasi* n. ssp. are allopatric, possibly separated by the steep slopes constituting the eastern rim of the Wadi 'Arava. Though I have seen no intermediate forms, the few specimens from the Wadi 'Arava being typical *pallida*, conclusive evidence of reproductive isolation is not yet available. Thus it seems best to accord the two forms subspecific rank.

In the northern part of its range *A. p. haasi* may be sympatric with *A. ruderata* Olivier. I have omitted the references for one of these forms having been recorded within the accepted range of the other, as probably some of these instances are based on mis-identifications. However, it is my impression that this is not so in all cases (see also Pasteur and Bons, 1960). It is interesting that it is easier to distinguish between *A. p. haasi* and *A. ruderata*, on the basis of general habitus, than between *A. p. pallida* and *A. ruderata*. Moreover, sexual dimorphism in SV length is apparently moderate in *A. p. haasi* (largest ♂, 89 mm (HUJ-R 1117); largest ♀, 93·5 mm (HUJ-R 1118)), whereas it is considerable in both *A. ruderata* (Pasteur and Bons, 1960) and *A. p. pallida* (among 117 specimens from Cisjordan in the Hebrew University collection, largest ♂, 75 mm (HUJ-R 7509); largest ♀, 87 mm (HUJ-R 5506)). These phenomena apparently represent a case of "sympatric character divergence" (Mayr, 1965 : 82).

It has been argued that *A. pallida* Reuss 1833 is conspecific with, and indistinguishable from, *A. mutabilis* Merrem 1820 (Pasteur and Bons, 1960; Wermuth, 1967). In fact, this possibility had already been mentioned by Anderson (1898). However, the arguments (and diagrams) of Pasteur and Bons do not entirely exclude the possibilities that these are either two distinguishable allopatric forms (Flower, 1933) (with a complex borderline, or intergrading), or even sibling (partly sympatric) species (Schmidt and Marx, 1956 : 25). It therefore seems most prudent to retain, at present, the specific name *pallida* for the populations to which it has traditionally been applied.

Agama blanfordi fieldi Haas and Werner

(Pl. 3 A)

Agama persica fieldi Haas and Werner, 1969. Bull. Mus. Comp. Zool. Harvard, 138 (6) : 337–339, pls. 2–6. (Saudi Arabia: Al-Caissumah – Turaif.)

MATERIAL EXAMINED (1). BM 1965.686 ♂ Qa el Umari (hard sand desert), 1965, S. Bisserôt.

PHOLIDOSIS. Dorsal scales subequal, keeled and shortly mucronate. Lateral scales similar but smaller. Ventral scales feebly keeled. Scales around middle of body, 80.

MEASUREMENTS. SV, 105 mm; tail, 163 mm.

COLORATION. Collector's note: "*A. persica* when first captured turned to a brilliant blue in the area of the dew-lap under the chin but not on any other part of the body. Both *A. sinaita* and *A. persica* turned blue when killed and preserved in spirit." (S. Bisserôt.) Yellowish grey*. Dorsally, four darker longitudinal bands, brown with still darker margins. Each band is of uneven width, and contains about six alternating dilated and constricted zones. Through the dilated zones run transverse series of white dots which are interrupted by a median light band. Each dot coincides with an enlarged scale, making it more conspicuous. On the head there are two brown wavy crossbands, preceded by a longitudinal patch of the same colour. On the tail the dorsal pattern gradually changes to one of simple dark rings. Belly with a distinct central longitudinal, grey band, and irregular lateral ones. Gular pouch dark grey with remnants of blue.

FIELD NOTES. "Three species of . . . Agamidae were seen and collected . . . on the flat dried sand areas only the one specimen of *A. persica* was found". S. Bisserôt.

REMARKS. This specimen is identifiable according to Boulenger's (1885) key as *A. blanfordi* (S. C. Anderson, 1966a; nom. subs. for *A. persica* Blanford 1881, nom. preoccup.) because of its unequal dorsal scales. However, the gular pouch and the scattered enlarged scales are less developed than in *blanfordi* and the head and body, especially the former, are more depressed than in this form. On the other hand, a series of very similar specimens collected in NE Saudi Arabia by Mr. Henry Field shows considerable variation in the development of the enlarged dorsal tubercles; several specimens have homogenous scaling and are thus identifiable as *isolepis* (Boulenger, 1885, lectotype from between Magas and Bampur, southeastern Iran—S. C. Anderson, 1966b). Similar, apparently, were the two specimens from Mesopotamia which Steindachner (1917) identified as "*isolepis* with a unique pattern". Our specimen is very similar to the pair depicted by him (at least in proportions, pattern, and non-meristic scale characters).

Apparently this is a form allied both to the *agilis-isolepis* Rassenkreis (Wettstein, 1951) and to *blanfordi*. It is, in certain respects, intermediate between the two. It is characterized by variably (mostly feebly) developed dorsal tubercles and gular pouch, and by a very distinctive pattern of longitudinal bands. A confusion concerning *agilis* and *blanfordi* had already been suspected by Schmidt (1941).

This new form has previously been referred to as *A. persica* Blanford. Thus at least part of the series mentioned by Haas (1957) belongs to *A. blanfordi fieldi*, as judged by specimen CAS 84541 (now HUJ-R 7081) and by his description of the pattern of CAS 84477. The latter description has been accepted by Khalaf (1959) as applying to *A. persica* Blanford though differing from that usually encountered in this species.

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*When examined by the author.

Agama sinaita von Heyden

(Pl. 3 B–E)

Agama sinaita von Heyden, 1827. In Rüppell, Atlas Reise nord. Afrika, Rept., p. 10, pl. 3 (Sinai).

Material examined (4). BM 1965.685 ♂ Wadi Ratan [W. Ratam] (basalt desert), April–May 1965, S. Bisserôt. BM 1965.801 ♀, BM 1965.802 ♂ Petra (on red and yellow sandstone respectively), 2 August 1965, D. Western. BM 1965.803 ♀ Wadi Musa, near Petra (basking on soil on top of rock), 4 August 1965, D Western.

Pholidosis. In the specimen from the basalt desert (BM 1965.685) the tail is moderately compressed laterally including its thick basal portion. The two dorsal rows of caudal scales are enlarged, their thick keels creating the impression of a slight crest. The specimens from Petra and Wadi Musa resemble specimens from Cisjordan in that the thick part of the tail is nearly cylindrical, and carries dorsally four straight rows of strongly keeled scales, the two median rows being little better developed than their immediate neighbours (Pl. 3 C & E).

Measurements. SV: 103, 69, 79, 79 mm. Tail of the last: 125 mm (other tails incomplete). In all specimens the third toe is hardly longer than the fourth (Pl. 3 B).

Coloration. "The ability of *A. sinaita* to change colour was observed on several occasions but did not appear to follow a regular pattern. Most specimens were observed to be a brilliant cobalt blue on first sight [Mountfort, 1965: plate 40a] but changed to a dark chocolate brown when pursued. One specimen kept alive changed from brown to blue over the head and shoulders and part of the flanks when food was put in its mouth. This reaction was repeated in captivity in this country [England] and was also caused by the temperature being raised to 80°F [27°C] or higher . . . *A. sinaita* turned blue when killed and preserved in spirit." (S. Bisserôt.)

Professor H. Mendelssohn (Tel-Aviv University) has studied the colour changes of this species, as part of his research of its behaviour, and found marked sexual dichromatism. Hence the arrangement of the following notes on our specimens.

Males: BM 1965.865 (preserved): blueish grey (throat and belly darker), tail grey (yellowish ventrally). 1965.802, collector's note: "bright blue all over, faded after death." The preserved specimen is dark grey, nearly black, with underparts lighter (and posteriorly very light) brownish grey.

Females: Collector's notes summarized: "head blue when alive, turning brighter blue when killed. Body grey with orange blotches". After preservation the heads are blackish, the bodies dark grey, and the tails have alternating darker and lighter transverse bands. The throats are grey (reticulated in 1965.801) and the abdomens steel grey; the remaining underparts are cream-white.

Remarks. The unusually large male with compressed tail, from the basalt desert, conceivably represents a distinct subspecies, but this cannot be assessed on the basis of a single specimen. (Wettstein, 1951 : 433, mentions three specimens from northern Transjordan, but gives no particulars apart from the colour.) The remaining specimens have tails similar to those of animals from southeastern Israel and northeastern Sinai, and the same is true of two collected by Haas between Guweira and Aqaba in 1936 (HUJ-R 1137, HUJ-R 5231). On the other hand, all the specimens from Transjordan are characterized by the third toe being hardly longer than the fourth. Specimens from southeastern Israel and northeastern Sinai usually have a longer 3rd toe (Pl. 3 B & D).

Agama stellio brachydactyla Haas

(Text-figs 4, 5)

Agama stellio brachydactyla Haas, 1951. Ann. Mag. Nat. Hist. (Ser. 12), 4 : 1052 (Israel : foot of Jebel Lussan, near Israel-Sinai frontier, S.S.W. of Beer-Sheba).

MATERIAL EXAMINED (3). BM 1965.787–789, Basta (remarks on habitats, under coloration), 3 August 1965, D. Western.

PHOLIDOSIS. A mid-dorsal band of unequal enlarged scales, about six times as broad as one of the larger scales. The transverse series of tubercles extend across this band. They are slightly interrupted medially but here some of the interstitial scales are almost as large as the tubercles themselves. All large scales are either distinctly keeled, mucronate, or spinous (Text-fig. 4).

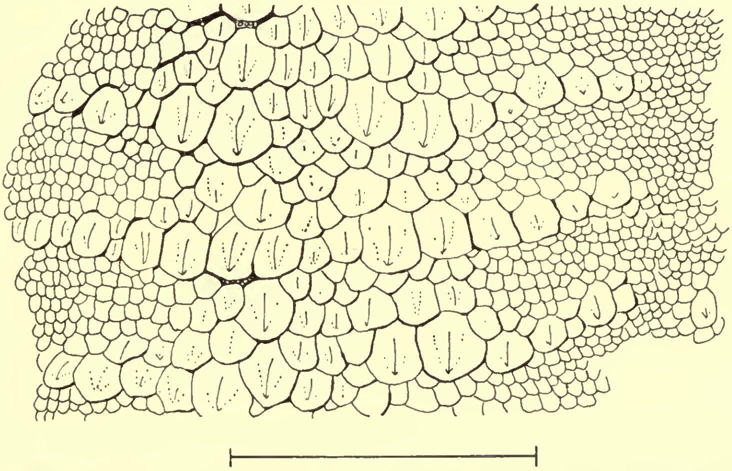


FIG. 4. *Agama stellio brachydactyla*. Mid-dorsal sclaes of BM 1965.787 from southern Transjordan (Basta). (From a photograph.) Scale, 10 mm.

Lamellae under 1st finger: 9, 10, 9. Under 4th toe: 22, 24, 22.

MEASUREMENTS. SV: 110, 84, 103 mm. Tail of smallest: 116 mm; other tails incomplete. Foot hardly longer than tibia, being shortest in largest specimen.

COLORATION. Collectors notes: 1965.787, "Back: black; black and yellow transversely striped tail; orange blotches near head (basking on orange mauve quarzite, 3.25 pm)." 1965.788, "Yellow and black with orange spots on neck. (On yellow sandstone, 4.20 pm)". 1965.789, "Brownish with orange and brown blotches. Tail black with orange transverse stripes. (On soil besides flintstone, 3 pm)".

In the preserved condition all three specimens are grey dorsally with pale yellowish blotches, the largest blotches arranged in mid-dorsal asymmetrical pairs, each pair tending to fuse and to form a large obliquely transverse blotch. On the tail, transverse bands of the same yellowish colour, which also covers the underparts, the throat being faintly reticulated with pale grey.

Remarks. All three specimens are presumably not fully grown. These individuals are not very typical *brachydactyla.* In the number of lamellae under the toes, as well as in the relative size of the mid-dorsal scales, they rather resemble specimens from the northern Negev in Israel, which are intermediate between *brachydactyla* and the form inhabiting mediterranean Israel. The specimens from Basta are assigned here to *brachydactyla* in accordance with their coloration and also in order to indicate their geographical affinities (Daan, 1967).

Six other specimens from Transjordan are available. Only one from Petra (HUJ-R 1096, 29 March 1935, Haas) shows a similar arrangement of a mid-dorsal band of subequal enlarged scales. Two other specimens from southern Transjordan (HUJ-R 1094 and 1103) and three from the Jerash-Amman area (HUJ-R 1101, 1110A, and 1110 B) have the dorsal transverse series of tubercles clearly separated by smaller scales, as is usual in specimens from northern Cisjordan.

The number of lamellae under the 4th toe in the nine specimens from the two areas in Transjordan is presented in Text-fig. 5 which also includes, for comparison, samples from five localities in Cisjordan. As the figure shows, in Cisjordan there is a pronounced north-south gradient in this character (with the higher values in the north). A parallel but less prominent gradient is indicated in Transjordan.

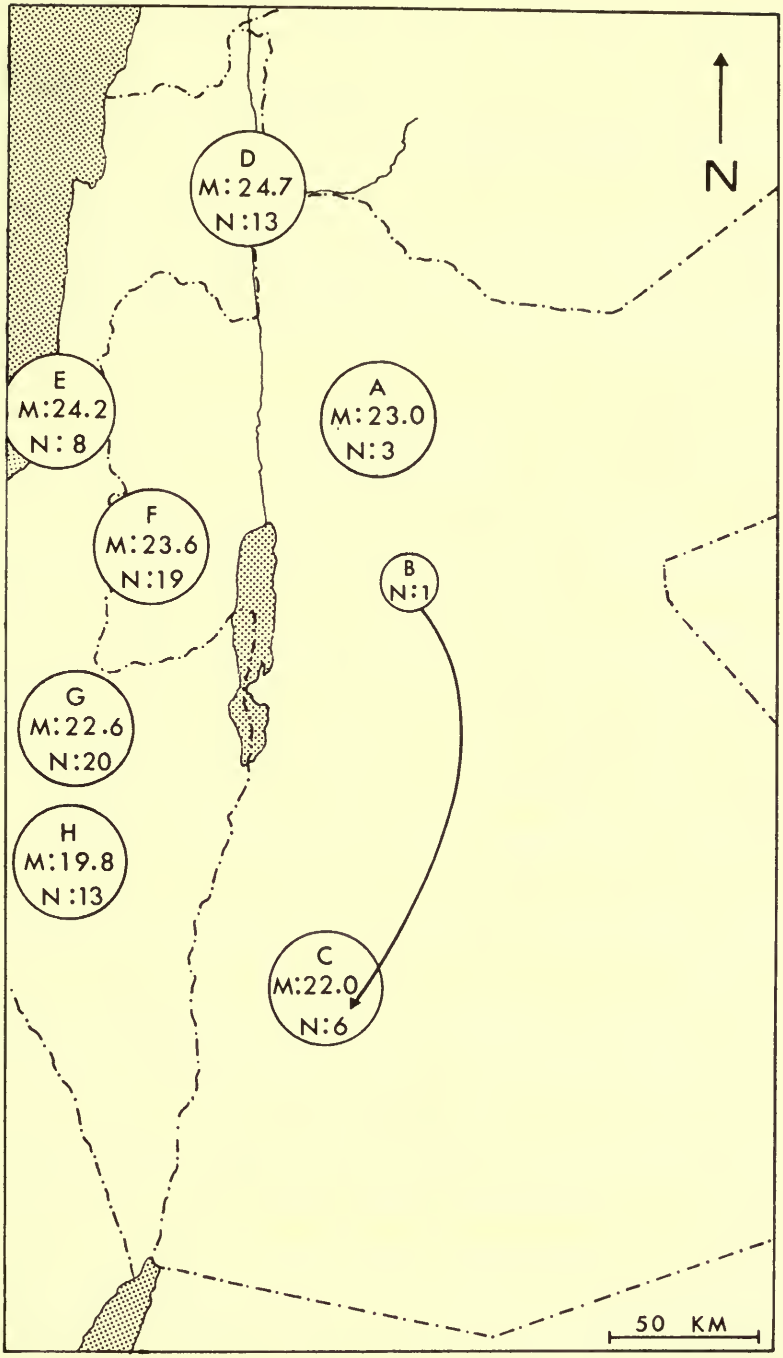
CHAMAELEONIDAE

Chamaeleo chamaeleon recticrista Boettger

Lacerta chamaeleon Linnaeus, 1758. Syst. Nat., p. 204 (Africa and Asia.)
Chamaelo vulgaris var. *recticrista* Boettger, 1880. Jahresber. senckenberg. naturf. Ges. Frankfurt, p. 198 (Jeruslaem and Haifa).

Material examined (1). BM 1963.667 juv. between Shaubak and Tafila (on camel thorn), 1963, S. Bisserôt.

Fig 5. *Agama stellio* subspp. Numbers of lamellae under fourth toe in Trans- and Cisjordan. Material included in each sample was collected within the area of the map covered by the relevant circle. (A) Jerash–Amman area; (B) Desert locality included in sample C; (C) Petra–Basta area; (D) Hills surrounding Lake Tiberias; (E) Ramot-HaShavim; (F) Jerusalem and adjacent Judaean Hills; (G) Be'er-Sheva and vicinity; (H) Sde-Boker–'Avdat area; M, Mean; N, Number of specimens. (Political frontiers as before 1966.)


N
D
M: 24.7
N: 13
E
M: 24.2
N: 8
A
M: 23.0
N: 3
F
M: 23.6
N: 19
B
N: 1
G
M: 22.6
N: 20
H
M: 19.8
N: 13
C
M: 22.0
N: 6
50 KM

Pholidosis. Gular and abdominal crest of enlarged scales present.

Measurements. SV: 44 mm; tail: 42 mm.

Coloration. Grey with irregular dots of darker grey. On each flank two longitudinal rows of five light cream blotches. Enlarged scales of dorsal, gular and abdominal crests the same light cream.

Remarks. A half-grown specimen from El-Hamma (NW Transjordan, in Israel HUJ-R 1501; 13 March 1945, Coll. G. Haas) is similarly coloured. In a juvenile from Jerash (HUJ-R 1502; 15 November 1945, Coll. Haas and Hoofien), measuring 36 mm (SV) the occipital casque is not (yet) developed. All three specimens conform to the chamaeleons of northern Israel rather than to the *C. c. musae*-like animals from further south (Hoofien, 1964).

LACERTIDAE

Acanthodactylus boskianus asper Audouin

Lacerta aspera Audouin, 1829. Descr. Egypte, Rept., Suppl., p. 173, pl. 1 fig. 9 (Egypt).
Acanthodactylus boskianus var. *asper* Lataste, 1885. Ann. Mus. Genova 2 (2) : 496.

Material examined (3). BM 1965.691 ♂ and BM 1965.693 ♀ Tell Quarma [=Tell Qarma] (blown sand wadi), April–May 1965, S. Bisserôt. BM 1965.804 ♀ Wadi Musa near Petra (sandy soil near bushes), 4 August 1965, D. Western.

Pholidosis. Scales across middle of body: 31, 38, but 55 in BM 1965.693. Gular scales in straight median series: 26, 32, 26. Lamellae under 4th toe: 21–22.

Measurements. BM 1965.691, 56 mm SV, 121 mm tail. BM 1965.693, 81 mm SV, and BM 1965.804, 62 mm SV (tails incomplete).

Coloration. BM 1965.804, collectors note: "brown: long orange stripes, spotted with black".

Remarks. Eleven other specimens from various localities in southern Transjordan (HUJ-R 1335, 1338, 1341, 1661, 5041–6, 5053) have the following pholidotic counts: Scales across middle of back, 29–51 (against 29–42 in southern Cisjordan, N = 24). Gular scales in a straight median line, 25–35 (24–31, in Cisjordan, N = 24). Lamellae under 4th toe, 19–22 (as in Cisjordan). Other conventional counts are also similar in Cis- and Transjordan except that some Cisjordan specimens show a reduction of the lateralmost ventral plates, so that only 8–9 longitudinal series are present.

In general, adult male *A. b. asper* are larger than females. The 2 largest males seen from Transjordan are 75 and 77 mm (SV), so that the female from Tel-Qarma (81 mm) appears unusually large.

The dorsal pattern of some Transjordan males includes rows of sharply defined blackish dots, instead of the more usual rows of irregular brownish spots.

***Acanthodactylus grandis* Boulenger**

(Pl. 4 A, B)

Acanthodactylus grandis Boulenger, 1909. Ann. Mag. Nat. Hist., 4 (8) : 189 (Jerud and Ataiba, Syria).

MATERIAL EXAMINED (2). BM 1965.692 ♀ Ain el-Enoquiyya (sand and stone wadi); BM 1965.694 ♀ Tell el Mukheizin (Hamada, beneath carcass of dog); both April–May 1965, S. Bisserôt.

PHOLIDOSIS. Scales across middle of body: 60; 60. In BM 1965.692 there is a fifth small upper labial before the center of the eye, on each side.

MEASUREMENTS. BM 1965.692: SV: 73 mm; tail: 126 mm. BM 1965.694: SV: 96 mm (tail incomplete).

COLORATION. BM 1965.692 (Pl. 4 B): Black spots, each covering up to ten scales, arranged in ten regular longitudinal rows, and in irregular transverse series. The two median rows begin at the occiput but disappear before the middle of the back; 4th and 5th row on each side present on flanks but absent from neck. Some rows extend on the tail, on the lateral sides of which the spots are represented as vertical blotches at every second suture between scale rings. Ground colour (preserved), nearly uniform grey (compare Pl. VI of Boulenger, 1923).

BM 1965.694 (Pl. 4 A): Six dark longitudinal stripes faintly indicated on back. Along these there are a few, irregularly scattered, small blackish spots, each covering up to 7 scales.

In both specimens the sides of the head bear alternate light and dark vertical bars, one of the latter passes through the eye.

REMARKS. All characters of both specimens are within the range of variation shown by *A. grandis* in the HUJ collection, some of which have been mentioned by Haas (1943; Transjordan between Hissa and Ma'an). There is some difficulty in distinguishing immature *A. grandis* from *A. scutellatus scutellatus*, which likewise has smooth scales, since the range of variation of almost all conventional scale counts is nearly identical (see also Boulenger, 1923 : 50). BM 1965.692 resembles *A. s. scutellatus* in the number of supralabials (5) before the center of the eye, and in its relatively long foot with moderately well developed pectination. The specimen however is certainly assignable to *A. grandis* for the following reasons:

The snout with its somewhat swollen nasals resembles that of other *A. grandis*, and not at all the pointed snout of *A. s. scutellatus*.

While five supralabials in front of the center of the eye are characteristic of *A. s. scutellatus*, and 4—of *A. grandis*, 5 may sometimes occur in the latter (see also Boulenger, 1921 : 114–115).

The longer foot and relatively stronger pectination (when compared to large *A. grandis* such as BM 1965.694) appear to be largely juvenile characters, which are paralleled in series of other species of *Acanthodactylus* containing mature and immature specimens. Moreover the pectination is still far less developed than in adult *A. s. scutellatus* from southern Israel.

The pattern conforms closely to that of *A. grandis* and differs most strikingly from that of *A. s. scutellatus*, as the latter never show any longitudinal arrangement of the markings.

Acanthodactylus tristrami tristrami Günther

(Pl. 4 C, D)

Zootoca tristrami Günther, 1864. Proc. Zool. Soc., p. 491 (Lebanon).
Acanthodactylus tristrami Boulenger, 1881. Proc. Zool. Soc., p. 746, pl. 64, fig. 1.

MATERIAL EXAMINED (1). BM 1962.352 ♀ Jordanian–Syrian border, Jerusalem–Damascus Rd (Outside customs shed) [probably loc. 1 on map], 4 June 1952, W. Larmuth.

PHOLIDOSIS. Scales across middle of body: 59. Longitudinal rows of ventrals: 11. Other characters also in agreement with Boulenger's (1921) data for *A. tristrami*.

MEASUREMENTS. SV: 82 mm; tail (tip missing): 86 mm.

COLORATION. The blackish markings tend to form a reticulum along each side of the dorsum (Pl. 4 C).

FIELD NOTES. "Died while ovipositing".

REMARKS. Angel (1936) described from NE Syria *A. t. orientalis* (48–56 scales across middle of body), which was also reported from the neighbourhoods of Rutba (Schmidt, 1939) and Mosul (Haas, 1952) in Iraq. From Haditha, Iraq, Schmidt (1939) described *A. t. iracensis* (45–46 scales across middle of body). Thus Günther's (1864) and Boulenger's (1921) *A. tristrami* was accorded subspecific rank as *A. t. tristrami* (58–65 scales across middle of body).

Our specimen appears assignable to the typical form, as well as two specimens in the HUJ collection, reported by Haas (1943): HUJ-R 1333 ♂, 15 km S of Amman, SV 92 mm; HUJ-R 1332 ♀, 45 km S of Amman, SV 69 mm (after a year in captivity). Scales across middle of body, 58, 57 respectively. Ventrals in 10 rows.

All three specimens are larger than Angel's *A. t. orientalis* (1936; 50–66 mm snout-vent, N = 8), although this alone would not have been taxonomically significant.

The dorsal pattern of HUJ-R 1333 (♂) consists of distinctly X-shaped blackish marks (Pl. 4 D; Boulenger, 1921). Markings intermediate between this pattern and the reticulum of BM 1962.352 (♀) are present on the female (the type ?) figured by Tristram (1885: Pl. 16, fig. 2).

Eremias brevirostris microlepis Angel

Eremias brevirostris microlepis Angel, 1936. Bull. Inst. Egypte 38 : 112–113 ("Haouarine" 55 km SE of Homs, Syria).

MATERIAL EXAMINED (2). BM 1965.689 ♀ (?) Qasr Amra (hamada); BM 1965.690 ♀ (?) Shishan (hamada); both, April–May 1965, S. Bisserôt.

Pholidosis. Scales across middle of body: 60; 62. Longitudinal series of ventral plates: 10. Plates in collar: 9. Gular scales in a straight median series: 29; 28. Femoral pores: 15, 14–15. Lamellae under 4th toe: 20; 24. Upper labials anterior to centre of eye: 5, the 5th being the first of two small false supralabials below the subocular.

Measurements. SV 46; 49 mm. Tail: 69 (tip missing); 81 mm.

Coloration. Both pale, the ocelli inconspicuous.

Field notes. "The blown sand areas in wadis were the chief habitat of the fringe-toed lizards, *Acanthodactylus* . . . however the lizard (*Eremias brevirostris*) was also seen in this habitat but not as frequently as on the hamada" (S. Bisserôt).

Remarks. Specimens from eastern and north-eastern Syria, like those from Iraq, are so far inseparable from the typical form (Angel, 1936; Schmidt, 1939; Haas and Werner, 1969). Angel's *microlepis* from western Syria (and a greater altitude) had been based on a single specimen, and was not regarded as valid by Haas (1957 : 73). However, the present two specimens from northern Transjordan agree fairly well with Angel's description. Furthermore, 13 specimens from central Transjordan (Amman–Ma'an) in the collection of the Hebrew University (Haas, 1943 : 14) show a clear affinity to *microlepis*, having 46–57 (commonest numbers 53–54) scales across the middle of the body, and also relatively small gular scales (21–29, usually 25–27, in a straight series). Interestingly a specimen from southern Transjordan (Guweira–Aqaba, HUJ-R 1230) has only 44 scales across the middle of the body (and 25 gulars). For comparison, Angel's (1936 : 112) *E. b. brevirostris* from NE Syria had 40–52 (commonest numbers 47–49) scales across the middle of the body, and 20–25, usually 21–23, gular scales in a straight series. Thus *E. b. microlepis* occupies the centre (around Jebel ed Druze) of the western distributional frontier of the species (Hoofien, 1957), possibly intergrading with the typical form to the north, east and south.

Eremias guttulata guttulata Lichtenstein

Lacerta guttulata Lichtenstein, 1823. Verz. Doubl. Mus. Berl., p. 101 (Egypt).
Eremias guttulata, A. Smith, 1845. Ill. Zool.. S. Afr., Rept., Pl. 48, fig. 8.
Eremias guttulata forma typica, Boulenger, 1921. Monograph of the Lacertidae, London, 2, p. 258.
Eremias guttulata guttulata, Wettstein, 1928. Sitzber. Akad. Wiss. Wien (math.-natur.) 137, Abt. 1, p. 782.

Material examined (1). BM 1965.688 ♂ 2 miles S of Azraq Druze (basalt desert), April–May 1965, S. Bisserôt.

Pholidosis. Scales across middle of body: 50. Longitudinal series of ventral plates: 8. Femoral pores: 13–14. Lamellae under 4th toe: 22–24. Upper labials preceding subocular (which enters lip): 4.

Measurements. SV: 46 mm. Tail: 83 mm (tip regenerated).

Coloration. The dark borders of the dorsal 'ocelli' are black and tend to merge with their neighbours laterally, forming incomplete black crossbands, which are interrupted by the white centres of the 'ocelli'.

Remarks. The snout is very elongated, pointed and flattened. In comparison with specimens from Cisjordan the pileus is smooth and flat, eyes and nostrils being little elevated.

Fourteen other specimens from various localities between Amman and Petra (HUJ-R 1237, 1240, 1256–7, 1259–60, 1262–3, 6236–8, 6273–4, 6300) have the following ranges of counts: Scales across middle of body, 44–57 (48–52 in 9 specimens). Longitudinal series of ventral plates, 10. Femoral pores, 10–14 (12–13 in 9 specimens). Lamellae under 4th toe, 18–24 (22 in 6 specimens). Upper labials preceding subocular, 4. The pileus, as in the Basalt Desert specimen, is relatively smooth and flat, although in a few specimens the nostrils (and sometimes the eyes too) are somewhat elevated.

The 3 largest specimens measure 50–51 mm (SV).

In none of these 14 specimens does the dark component of the pattern occupy such a large area as in the specimen from the Basalt Desert, nor is this component black. In some specimens it is brown, in others, pale to the point of becoming indistinct. Some specimens show a tendency for lateral confluence of 'ocelli', but the resulting pattern resembles strings of beads rather than crossbands of uniform width. The range of coloration known from Cisjordan resembles that shown by these 14 specimens. Thus the Basalt Desert specimen is outstanding in its black and extensive dark pattern, perhaps as an adaptation to its habitat.

Ophisops elegans blanfordi Schmidt

(Text-figs 6, 7)

Ophisops blanfordi Schmidt, 1939. Zool. Ser. Field Mus. Nat. Hist., 24 (7) : 64–65 (Halfaya, 20 miles east of Amara, Iraq).

Material examined (2). BM 1963.668 ♂ N of Shaubak, 1963, S. Bisserôt; BM 1965.687 ♀ Ain el Enoquiya (sand and stone wadi), April–May 1965, S. Bisserôt.

Pholidosis. Scales and plates around middle of body 38; 34. Femoral pores: 10–11; 10–11. Lamellae under 4th toe: 22–24. Upper labials preceding subocular: 4. Third postsubocular in broad contact with auricular. Postnasal: single. Occipital of medium size (somewhat larger than postnasal).

Measurements. SV: 42; 40 mm. Tail of ♂: 92 mm; of ♀ missing.

Coloration. Both have the usual *Ophisops elegans* pattern except that there is a distinct dark vertebral line running from the occiput to the pelvic region.

Remarks. Both specimens agree with Schmidt's description, except in having a slightly higher number of scales around the body (Schmidt's 92 specimens, all from the lower Tigris-Euphrates Valley, had 30–36 scales and plates around the middle of the body, averaging 33).

The dark vertebral line observed in the two specimens from Transjordan occurs only rarely in *O. e. ehrenbergi* from Cisjordan (N = 50), and then only on the neck. Likewise, Lantz (1930 : 41) says of the pattern of *O. e. elegans* "Dessin caractérisé per la bande occipitale rudimentaire . . . Bande occipitale absente ou reduite à un petit trait ou à quelques petites taches noires sur la nuque." It is much commoner, and better developed, in *O. e. schlueteri* from Cyprus (N = 16).

Ophisops from Transjordan in the HUJ collection fall into two groups. All those from Jerash and its vicinity (N = 16: HUJ-R 1190, 1203, 1204/1–2, 1205, 1206/1–4, 1207/1–3, 1208/1–2, 1209, 1561) have double postnasals. In most of them, the vertebral line is either absent, or confined to the occipital region; but in 3 ♂♂ it extends to the shoulders and in a single male it reaches the midbody although it is very faint. These specimens appear to be assignable, like all those from Cisjordan, to *O. e. ehrenbergi*. On the other hand, specimens from between Amman and Petra are assignable to *blanfordi* (N = 9: HUJ-R 1183, 1186, 1218, 1220–22, 6158–60). Of these, 5 have single postnasals, 3 have double postnasals, and one is

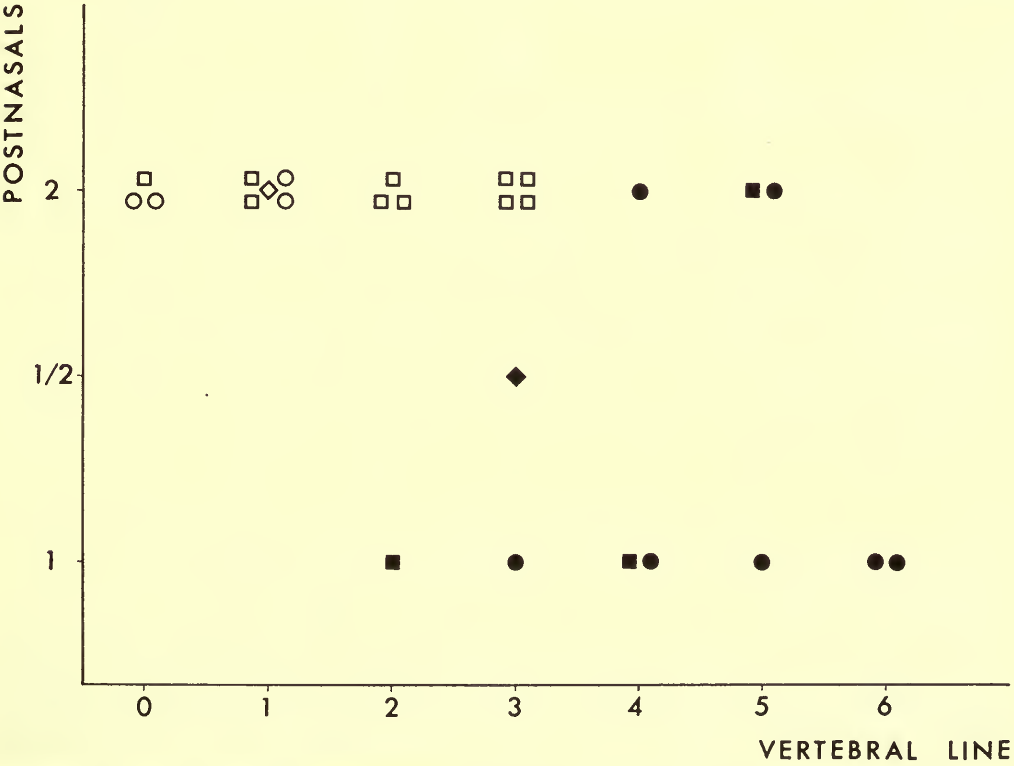


FIG. 6. *Ophisops elegans* subspp. from Transjordan. Number of postnasals against extent of vertebral line (0, none; 2, only on occiput; 3, reaching shoulder; 4, reaching midbody; 5, reaching pelvis; 6, reaching tail base. These values are adjusted by + 1 for unusually intense lines, and by –1 for particularly faint ones). Open symbols, *O.e. ehrenbergi* from the Jerash area; Solid symbols, *O. e. blanfordi* (details in text); Squares, males; Circles, females; Diamonds, juveniles.

asymmetrical. In most the vertebral line is well developed and this is particularly true of those with double postnasals. Thus the two forms are distinguishable by the combination of these two characters (Text-fig. 6). Possibly they are also distinguishable by a combination of femoral pore number and vertebral line extent (Text-fig. 7).

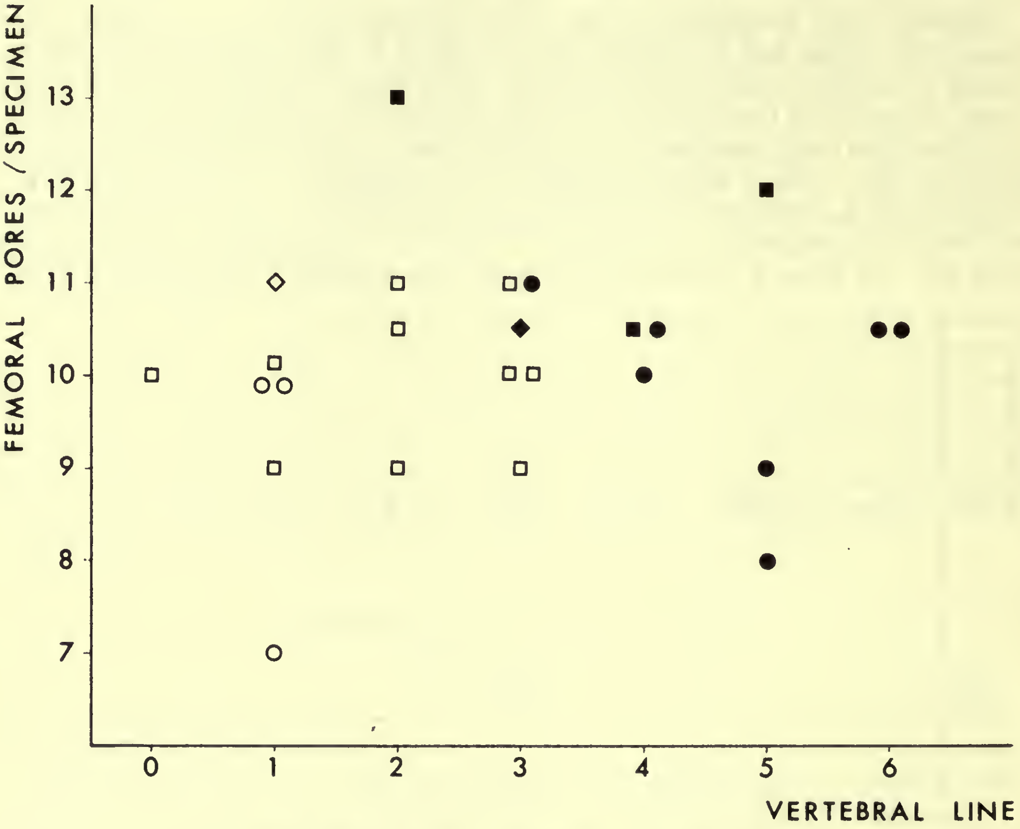


Fig. 7. *Ophisops elegans* subspp. from Transjordan. Number of femoral pores (represented for each specimen as the mean of both femurs) against extent of vertebral line. Symbols as in fig. 6.

The 9 HUJ *blanfordi* specimens have the following scale counts: Scales and plates around middle of body, 29–44 (39–41 in 4 specimens); Femoral pores, 8–13; Lamellae under 4th toe, 20–25. Neither these nor the remaining conventional counts differ markedly from those found in *O. e. ehrenbergi*.

In conclusion, while the *Ophisops* of the Jerash district appears to be consubspecific with *O. e. ehrenbergi* of Cisjordan, the form occurring in the more arid parts of Transjordan is Schmidt's *O. blanfordi*. This, however, does not seem to merit specific rank since there are indications of intergradation with *O. elegans* in Transjordan (details above) and Iraq (Haas and Werner, 1969), and there is no evidence of sympatry. Two additional alleged *blanfordi* characters in fact occur also in (other) *O. elegans*: the small temporal scales, which occur in *O. e. schlueteri* (Cyprus); and the situation of the third post subocular which in *O. e. ehrenbergi* (Cisjordan) and *O. e. schlueteri* sometimes touches and sometimes fails to touch the auricular.

SCINCIDAE

Chalcides ocellatus ocellatus Forskål

Lacerta ocellata Forskål, 1775. Descr. Anim., p. 13 (Egypt).
Chalcides ocellatus forma typica, Boulenger, 1890. Ann. Mag. Nat. Hist. 5 : 444–445.
Chalcides ocellatus ocellatus Wettstein, 1928. Sitzber. Akad. Wiss. Wien (math.-natur.), 137, Abt. I, p. 784.

Material examined (1). BM 1965.785 Aqaba (on rocks close to beach, Red Sea coast), 5 August 1965, D. Western.

Pholidosis. Scales around the middle of the body: 30.

Measurements. SV 61 mm; tail: 69 mm.

Coloration. Collector's note: "brown with darker brown and white spots". The 'ocelli' are numerous and are arranged in transverse series on the neck and tail. They are small, each occupying less than a single scale.

Remarks. Two out of 3 specimens (the 3rd being damaged) from 65 miles SSE of Amman (HUJ-R 1442, 5107, 5108—June–July, 1938 Haas) have 28 scale rows. The same applies to HUJ-R 1469 from El-Hamma (NW Transjordan within Israel—13 March 1945, Haas). The pattern of HUJ-R 5107 is remarkably irregular, many of the 'ocelli' having only a black spot on one side of the white centre instead of a complete border. In HUJ-R 1442 and 5108 (juveniles) there are only faint indications of 'ocelli'. The specimen from El-Hamma has 'normal' 'ocelli', each occupying a scale.

Eumeces schneideri princeps Eichwald

(Pl. 5 B)

Euprepes princeps Eichwald, 1839. Bull. Soc. Imp. Nat. Moscow, 2 : 303–307 ("In ora Caspia occidentali, ad montes praesertim Talyschensis").
Eumeces princeps, Taylor, 1935. Kansas Univ. Sci. Bull., 23 : 138.
Eumeces schneideri princeps, Eiselt, 1940. Zool. Anz., 131 : 218.

Material examined (1). BM 1965.695 ♂ Ain el Enoquiyya (basalt desert), April–May 1965, S. Bisserôt.

Pholidosis. Scales around middle of body: 27. Dorsal scales from occiput to above cloaca: 67.

Measurements. SV: 115 mm (tail regenerated).

Coloration. Ground colour of back light brown. No light spots. Along the flank a dark brown band, 2–3 scales broad; its lower border half a scale above the light lateral band, its upper border fairly sharp (Pl. 5 B). The light lateral band is intensely white. (It may have been yellow at the time the animal was killed, six months prior to its examination by me.)

REMARKS. The scale counts of this specimen are characteristic of *princeps* (Eiselt, 1940: Table 1), but the colour is unusual, and may represent an adaptation to the basalt desert. A specimen from Shaubak (BM 1963.669) here assigned to *schneideri* shows some tendency towards a similar coloration. However, a specimen collected 65 miles SSE of Amman (HUJ-R 1389) and clearly assignable to *princeps* (27 scale rows, 69 dorsal scales from occiput to above cloaca) is uniformly coloured having neither light spots nor darkened flanks, the light lateral band merging with the light belly.

Eumeces schneideri schneideri Daudin

(Pl. 5 A, C)

Scincus schneideri, Daudin, 1802. Hist. Nat. Rept., 4 : 291.
Eumeces schneideri (part*), Taylor, 1935. Kansas Univ. Sci. Bull. 23 : 126.
Eumeces schneideri schneideri, Eiselt, 1940. Zool. Anz., 131 : 213.

MATERIAL EXAMINED (2). BM 1963.669 N of Shaubak, 1963, S. Bisserôt. BM 1965.786 Petra (on red sandstone), 1965, D. Western.

PHOLIDOSIS. Scales around middle of body: 26, 24. Dorsal scales from occiput to above cloaca: 65, 66.

MEASUREMENTS. Largest (BM 1965.786): SV: 114 mm; tail: 209 mm.

COLORATION. Both specimens have the usual light lateral band passing through the ear. BM 1963.669 (Pl. 5 C): Only a few small light (originally yellow-orange ?) spots, each covering up to a third of a scale. Flanks mottled dark brown above the light band; each dark spot covering the posterior portion of a scale. BM 1965.786 (Pl. 5 A): collector's note: "green with orange spots". The spots each cover up to a whole scale, and are irregularly arranged; a tendency to form transverse series is particularly evident on the tail.

REMARKS. These specimens were collected relatively near the area where, in Israel, the northwestern *pavimentatus*, and the southern *schneideri* intergrade. In southern Israel and in Sinai (Schmidt and Marx, 1956 : 28) there occur populations in which the pattern is regularly of the *schneideri* type, but the scale counts of many specimens tend towards those characterizing *pavimentatus* (Eiselt, 1940: Table 1). This situation is exemplified by BM 1965.786 from Petra, which it seems best to assign to *schneideri* (see also Taylor, 1935 : 130) like the specimens from southern-most Israel. BM 1963.669 from North of Shaubak has 26 scale rows, and its very broad dorsal scales exclude it from *princeps*.

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*Taylor includes in *schneideri* single specimens from "Haiffa" and "Mt. Jerusalem", within the range of *pavimentatus*. These specimens evidently are adult males of *pavimentatus* which, unlike the females, lose the whitish streaks adorning the young. The orange spots however, remain arranged in longitudinal rows (see his Plate 5).

Mabuya vittata Olivier

Scincus vittatus Olivier, 1804. Voy. Emp. Ottoman, 3, p. 103, pl. 29, fig. 1 (sands west of Rosetta).
Mabuia vittata Boulenger, 1887. Cat. Lizards Brit. Mus., 3, p. 176.

Material examined (1). BM 1963.670 2 km SE Druze village, Azraq, 1963, S. Bisserôt.

Pholidosis. Scales around middle of body: 32.

Measurements. SV: 73 mm; tail: 80 mm.

Coloration. Dorsum brown, with three light longitudinal bands. No darker spots, except tiny ones on occiput.

Remarks. Of 4 specimens from the surroundings of Jerash (HUJ-R 1423, 1424, 1426, 1547; November 1945, Coll. Haas and Hoofien), 3 have 32 scales around the middle of the body, and one has 34. The largest of these measures 95 mm (SV). The pattern varies: one specimen resembles BM 1963.670, but another has 5 light bands, and two have 4, the median one being obliterated. The other 3 specimens have most dorsal scales partly edged in black (or dark brown), particularly towards the borders of the light bands. In Cisjordan, too, the pattern and colour of this species are highly variable (*cf.* Peracca, 1894 : 8).

OPHIDIA

COLUBRIDAE

Natrix tessellata tessellata Laurenti

Coronella tessellata Laurenti, 1768. Synops. Rept.: 87 ("in Japidia, vulgo Cars").
Natrix tessellata, Bonaparte, 1834. Iconogr. Faun. Ital., 2, 11 : plate.
Natrix tessellata tessellata, (Hecht) 1930. Mitt. zool. Mus. Berlin, 16 : 319.

Material examined (1). BM 1965.696 juv., Shishan (sandy area nr. date palms), 1965, S. Bisserôt.

Pholidosis. Scale rows: 19. Ventrals: 165. Subcaudals: 62.

Measurements. SV: 190 mm; tail: 45 mm.

Remarks. Three juveniles from Birketen near Jerash (HUJ-R 3024, 3063, 3071; November 1945, Coll. Haas and Hoofien) have 164–166 ventrals and 65–67 subcaudals. In Cisjordan (N = 9), similarly, 160–169 ventrals and 56–66 subcaudals have been counted.

Coluber rhodorhachis rhodorhachis Jan

(Pl. 6 A, B)

Zamenis rhodorhachis Jan, 1865. In De Filippi, Viagg. in Persia, p. 356 (Iran; restricted by Kramer and Schnurrenberger, 1963, p. 501, to Schiras, Central Persia.)
Coluber rhodorhachis, Parker, 1931. Ann. Mag. Nat. Hist., (10), 8 : 516.
Coluber rhodorhachis rhodorhachis, Khalaf, 1959. Reptiles of Iraq with some notes on the Amphibians, Baghdad, pp. 75–76.

MATERIAL EXAMINED (1). BM 1965.805 ♀ Petra, 1965, D. Western.

PHOLIDOSIS. Scale rows: 19. Ventrals: 242. Subcaudals: 133.

MEASUREMENTS. SV: 790 mm; tail: 320 mm.

COLORATION. Dark crossbands on anterior part of back (65–70) somewhat irregular, nearly four times as broad as the light intervening spaces. First dark crossband (on the occiput) interrupted mid-dorsally by a faint light vertebral line (Pl. 6 A).

REMARKS. This is apparently the first formal record of *C. rhodorhachis* from Transjordan proper. The range extension involved is only minor, as the species is well known in the Wadi 'Arava (Haas, 1951).

Although this specimen was collected at Petra, and its pholidosis agrees with material from the adjacent territory of Cisjordan, its coloration deviates markedly from that found in these specimens. In Cisjordan the dark crossbands are usually distinctly narrower than the intervening light spaces (Pl. 6 B), or at the most as broad as the latter. The same appears to be true of Egyptian specimens (Anderson, 1898: pl. 35). On the other hand, I have seen broad and close dark crossbands, like those of the Petra specimen, in an example from Iran (MCZ 58872), though in this case only the anterior 30–35 crossbands are so broad, the more posterior ones gradually become narrower. The similarity of these two specimens does not, however, mean very much, as the species exhibits high variability of colour and pattern.

Terent'ev and Chernov (1949 : 242) accept *C. r. ladacensis* Anderson 1871 (Boulenger, 1890 : 326) as a distinct form. Mertens (1956 : 95) and Kramer and Schnurrenberger (1963 : 501) doubt its validity. In fact, Anderson himself (1895 : 654, footnote 1) says "I am indebted to the Trustees of the Indian Museum for the opportunity of re-examining the types of *Z. ladacensis*. They are unquestionably identical with Jan's *Z. rhodorhachis*. At the time I described the species, Jan's work was not in the library of the Indian Museum, Calcutta". Thus, so far all *Coluber rhodorhachis* specimens, apart from the Somalian *C. r. subnigra* Boettger 1893 (Parker, 1949 : 30–37), are assignable to the typical form.

Coluber rogersi Anderson

(Pl. 6 C, D)

Zamenis rogersi Anderson, 1893. Ann. Mag. Nat. Hist. (6)12 : 439 (Desert to the east of Helwan, near Cairo).
Coluber rogersi, Flower, 1933. Proc. Zool. Soc. London, p. 810–811.

MATERIAL EXAMINED (2). BM 1965.698 ♂ Five km S of Aseikhim, April–May 1965, S. Bisserôt. BM 1965.806 juv. ♂ (?) Azraq, 1965, D. Western.

PHOLIDOSIS. Scale rows: 19; 19. Ventrals: 195; 204. Anals divided. Tails incomplete.

MEASUREMENTS. SV: 565; 220 mm. (Tails incomplete.)

COLORATION. In both specimens, the anterior three-quarters of body has about 55 dark, closely set, dorsal blotches (Pl. 6 C). Posteriorly the blotches gradually become indistinct. The first three blotches are confluent mid-dorsally to form a longitudinal streak behind the occiput. Tail uniformly grey.

REMARKS. The pattern resembles that normally encountered in (southern) Cisjordan (Pl. 6 D), the blotches being closer to each other than those figured by Anderson (1898: pl. 36) for a male from "Beltim" (Nile delta). The scale count appears to be higher in Transjordan than in Cisjordan: Two specimens from 65 km SSE of Amman have 200 ventrals each (HUJ-R 3183/1 and 2); one from N of Zerka has 195. Thus while in Cisjordan we find 188–200 ventrals (N = 13), we find 195–204 (N = 5) in Transjordan. A single specimen from Iraq has 206 (HUJ-R 3540).

Malpolon moilensis Reuss

Coluber moilensis Reuss, 1834. Mus. Senckenb. 1, p. 142 (near Moila, on the Red Sea coast of Arabia).

Malpolon moilensis, Parker, 1931. Ann. Mag. Nat. Hist. (10) 8 : 522.

MATERIAL EXAMINED (1). BM 1965.697 ♂ (?). Three miles N of Druze (Track through hamada), April–May 1965, S. Bisserôt.

PHOLIDOSIS. Scale rows: 17. Ventrals: 166. Anal divided. Subcaudals: 50.

MEASUREMENTS. SV: 443 mm; tail: 95 mm.

COLORATION (After preservation). Brown with darker brown spots, of varying distinctness, which are arranged in eight longitudinal rows. Neighbouring spots tend to merge, forming obliquely transverse streaks. A conspicuous dark brown blotch is present on each temporal region.

REMARKS. This appears to be the first record of this snake from Transjordan. The species has recently been recorded from southern Cisjordan, where it is rare (Barash & Hoofien, 1956). Most, if not all, specimens were actually found in the Wadi ʻArava, so that the inclusion of this species in the fauna of Transjordan would have been a matter of course. The locality recorded here, however, constitutes a significant range extension.

Malpolon monspessulanus insignitus Geoffroy

Coluber insignitus Geoffroy in Savignyi, 1827. Descr. Egypte., Hist. nat., 1 Rept.: 151; pl. 7, Fig. 6 (Lower Egypt).

Malpolon monspessulanus insignitus, Mertens and Müller, 1928, Abh. senckenberg. naturf. Ges., Frankfurt a.M., 41 : 51.

Material examined (1). BM 1965.807 ♂ Azraq, 1965, D. Western.

Pholidosis. Scale rows: 19. Ventrals: 173. Anal divided. Subcaudals: 83.

Measurements. SV: 745 mm. Tail: 210 mm.

Coloration (After preservation). Nearly uniform dark grey. Belly whitish with some light grey mottling.

DISCUSSION

The material reported here does not on its own permit an analysis of the herpetofauna of Transjordan in terms of ecology or zoogeography. However, the specimens have been assembled on several trips, so that at least the lizard material probably reflects to some extent the abundance of the species in certain habitats and localities. It thus seems profitable to relate the data available to existing general information on the ecological and biogeographical subdivision of Transjordan and to the known circumstances in Cisjordan.

General Biogeography of Transjordan

The variegated zoogeography of Transjordan was outlined by Bodenheimer (1935 : 24). His basically correct map (1935: Fig. 6) was superseded by the more recent work of botanists (Bodenheimer, 1953 : 85). Feinbrun and Zohary prepared a phytogeographical map (1955 : 15) dividing Transjordan into the same three territories, Mediterranean, Irano-Turanian, and Saharo-Sindian, into which Cisjordan is also divided (Zohary, 1955). This division, based on the mapping of plant associations (Feinbrun and Zohary, 1955: folding map), is related to the distribution of soil types and, more closely, to that of rainfall (maps, Feinbrun and Zohary, 1955 : 9 and 13; Poore and Robertson, 1964 : 12; Bender, 1968 : 10 and 180). The phytogeographical map of Feinbrun and Zohary (1955 : 15) furnished the basis for the delimitation of biogeographical territories in Text-fig. 8. (A fourth territory, the 'Sudanian Penetration Territory', has been proposed for the Lower Jordan Valley and the Wadi 'Arava by Gruenberg-Fertig, 1965). The general ranges of the three biogeographical territories in southwestern Asia are presented by a map recently published elsewhere (Haas and Werner, 1969 : 368).

Poore and Robertson (1964 : 14–15) similarly classified the Transjordanian range types into three basic regions: Mediterranean, Steppe, and Desert of varying type (limestone, basalt, sandstone and granite deserts). The salient differences between the two maps are few: The Mediterranean region of Poore and Robertson is narrower (in W–E direction) than that of Feinbrun and Zohary (shown here in Text-fig. 8) so that for instance, Petra, Tafila and Shaubak are excluded from it (the first lying just west of, the two last, just east of, Poore and Robertson's Mediterranean region). The Steppe region of Poore and Robertson, roughly coinciding in the south with Feinbrun and Zohary's Irano-Turanian territory, reaches in the north eastwards to only halfway between Amman and Azraq. (Guest (1966: Figs 13, 14) apparently includes the area around, and east of, Azraq, in the Irano-Turanian, in agreement

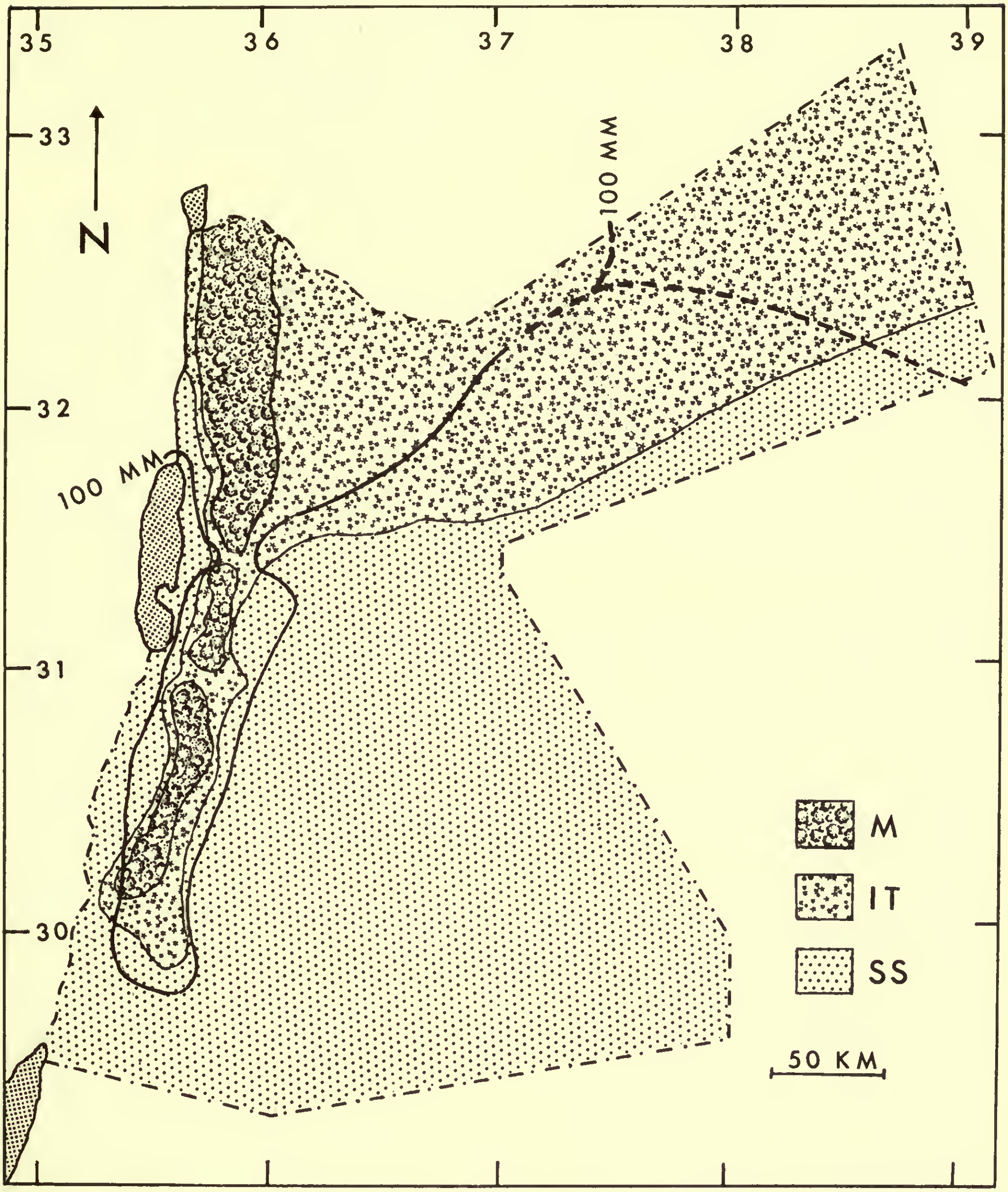
35
36
37
38
39
33
32
31
30
N
100 MM
100 MM
M
IT
SS
50 KM

FIG. 8. The biogeography of Transjordan, based on Feinbrun and Zohary (1955). The 100 mm mean annual precipitation line is based on Poore and Robertson (1963); its interrupted part (extrapolated alternatives in area lacking data) is based on various sources. M, Mediterranean; IT, Irano-Turanian; SS, Saharo-Sindian.

with Feinbrun and Zohary.) At the latitude of the Dead Sea Poore and Robertson's Steppe region has a south-eastern extension (as compared to Feinbrun and Zohary's Irano–Turanian territory) so as to include El Qatrane. The desert regions of Poore and Robertson include areas excluded from Feinbrun and Zohary's Saharo–Sindian territory. Firstly, the district around, and east of, Azraq; secondly, a broader zone in the Jordan Valley and especially in its northern part. Thus, Salt (NW of Amman) and Petra are well within the Mediterranean territory of Feinbrun and Zohary, but on the fringe of the desert according to Poore and Robertson.

The bioclimates of Transjordan have been defined and mapped by Long (1957; also in Poore and Robertson, 1964 : 10, and 13). His map corresponds closely to the two biogeographical maps just discussed; concerning the district surrounding, and east of, Azraq, it is intermediate between them. The climates of the Mediterranean territory are "sub-humid and semi-arid mediterranean bioclimates"; those of the Irano–Turanian (~ Steppe) territory are "arid mediterranean bioclimates"; and the Saharo–Sindian (~ desert) territory has "saharan mediterranean bioclimates". Among the latter, the "cool variety" characterizes the Azraq district. Long's map differs from the phytogeographical maps chiefly in that his "semi-arid mediterranean bioclimate" (~ Mediterranean territory) reaches southwards only to a point between Shaubak and Petra. However, this difference may conceivably result from the paucity of meteorological information available to Long (Poore and Robertson, 1964 : 11).

Thus Transjordan comprises three gross ecological, hence biogeographical territories. Relying on the sources cited, these may be briefly characterized as follows:

The Mediterranean territory includes the hills of Gilead and the western parts of Ammon, Moab and N Edom. In the south this narrow territory is confined to the higher hills, and interrupted between them. Predominant soils are terra-rossa, white Cenomanian soil and grey Senonian soil; along the Jordan Valley, areas of Nubian sandstone are included. The bioclimate conforms in the main to the semi-arid mediterranean type. Annual rainfall varies from about 700 mm on northern mountaintops down to ca. 300, and even below 200, south of Petra. Vegetation is characterized by a climax of Mediterranean Maquis and forest types, and by areas covered with various shrubs, including many Labiatae.

The Irano–Turanian territory surrounds the Mediterranean territory except in the north (where the latter continues into Syria and Lebanon). Above latitude 31° 30′ N the otherwise narrow zone widens eastwards, extending to at least halfway between Amman and Azraq, possibly to the frontier. The commonest soils are loess and grey calcareous steppe soils (Basalt from Azraq to Burqu). The bioclimate is of the arid mediterranean types (of the saharan mediterranean type, cool variety, around Azraq); annual rainfall is between ca. 350 mm and ca. 100 mm. Vegetation is typically a steppe of dwarf-shrubs (*Artemisia herba-alba* is prominent) or of herbs (*e.g. Poa sinica* and *Carex pachystylis*), and includes remnants of a *Pistacia atlantica* forest.

The Saharo–Sindian territory occupies the vast southern and eastern desert of Transjordan, as well as the lower parts of the Rift Valley. The greatest part, north of latitude 29° 40′ N, is characterized by lime-stone hamadas, the ground generally being covered by a layer of flints. Further south, and in the Rift Valley, Nubian sandstone and sand predominate, with an area of granite (rock and sand) in the Wadi ʻArava. A vast basalt desert, from Azraq to Burqu, is largely covered by basalt boulders of varying size. The bioclimates are of the Saharan Mediterranean types. Rainfall is normally below 150 mm, in the extreme southeast below 50 mm. Vegetation is scanty except in the wadis. Associations of *Anabasis articulata* are prominent, and on granite sands—*Haloxylon* spp.

Distribution of Reptiles

This discussion is limited to the 23 species and subspecies reported here. Among these, 16 occur also in Cisjordan. Two ubiquitous species were collected in all three regions of Transjordan (and similarly occur in all parts of Cisjordan): *Hemidactylus turcicus* and *Chalcides o. ocellatus*. These have an essentially circum-mediterranean distribution, which is particularly broad to the south and east. *Agama stellio* is similarly circum-eastern-mediterranean, but unfortunately its infraspecific taxonomy is not clear.

Four forms occur in Cisjordan as Mediterranean elements: *Chamaeleo chamaeleon recticrista, Mabuya vittata, Natrix t. tessellata* and *Malpolon m. insignitus*. The first three are here reported from the Mediterranean territory of Transjordan; *Mabuya vittata* and *Natrix t. tessellata* were also found at Azraq or at the neighbouring Shishan (within the disputed area belonging to either the Irano–Turanian or Saharo–Sindian territory). *Malpolon m. insignitus* is reported from Azraq. This distribution is probably due to the local conditions prevailing at these places. *N. t. tessellata* is semiaquatic; *M. vittata* is facultatively hydrophilic, and lives, *e.g.*, also among reeds surrounding the salt marshes south of the Dead Sea (pers. obs.).

Seven reptiles typical of Cisjordanian desert habitats were collected in the Irano–Turanian and Saharo–Sindian areas of Transjordan: *Agama sinaita, Acanthodactylus b. asper, Eremias g. gutulata, Eumeces s. schneideri, Coluber rhodorhachis, C. rogersi,* and *Malpolon moilensis*. We shall consider first the two *Coluber* species. All of 4 localities for *Coluber rogersi* fall within the Irano–Turanian (according to Feinbrun and Zohary; but 2 within the desert according to Poore and Robertson.). In Cisjordan this snake occupies both the Irano–Turanian and Saharo–Sindian territories, with the exception of the (hot) Wadi ʻArava. Its world distribution is Saharo–Sindian and to some extent, Irano–Turanian. *C. rhodorhachis* occurs in Cisjordan mainly in the Saharo–Sindian territory (Wadi ʻArava and southern Negev), and the first and only record for Transjordan is from Petra, on the fringe of the Wadi ʻArava. Its world distribution is Irano–Turanian and Saharo–Sindian. The two lacertids, *A. b. asper* and *E. g. guttulata*, are reported from both Irano–Turanian and Saharo–Sindian localities in Transjordan. Similarly, they are known in Cisjordan from suitable habitats throughout the Negev. Their world distribution is Saharo–Sindian. The remaining forms, *Agama sinaita, Eumeces s. schneideri* and *Malpolon moilensis*, were taken in Transjordan at more or less desertic localities (at least according to Poore and Robertson). In Cisjordan these are restricted to the Saharo–Sindian part of the Negev, and their world distribution is Saharo–Sindian.

The ranges of the two forms of *Ptyodactylus* apparently fail to coincide with any of the ecological territories described above. *P. h. puiseuxi*, a morphologically well defined form, is common in northernmost Cisjordan and in Transjordan, on the hills bordering Lake Tiberias on the east, and around Jerash—all in the mediterranean territory—but is here reported also from the fringe of the basalt desert ca. 10km E of Azraq (Wadi Aseikhim). It may eventually turn out to be basically a form inhabiting basalt rocks, which has spread to adjacent habitats. *P. h. guttatus* is less well defined and in particular not clearly distinguishable from *P. h. hasselquistii*. Geckos currently assigned to *guttatus* are common in the Mediterranean, Irano–Turanian and Saharo–Sindian territories of Cisjordan—in effect throughout the country excepting its northern and southern extremes. So far, our records for Transjordan are all within the (southwestern) Saharo–Sindian (Rum; S of Guweira) or on its rim (Petra; Wadi Musa). Evidently the ranges of these two geckos are influenced to a great extent by factors other than the climate, perhaps because they can modify their exposure to it by varying the relative duration of nocturnal and diurnal activity.

Of the Transjordanian reptiles reported here, seven forms do not occur in Cisjordan. Of these, six are apparently Irano–Turanian elements, as far as their general ranges are concerned: *Agama p. haasi*, *Acanthodactylus grandis*, *A. t. tristrami*, *Eremias b. microlepis*, *Ophisops e. blanfordi*, and *Eumeces s. princeps*. In Transjordan, *A. p. haasi* has been collected mostly within the Irano–Turanian, but also within the Saharo–Sindian. In Cisjordan, *A. p. pallida* similarly occurs in both territories. *A. grandis* has been collected in the Irano–Turanian and Saharo–Sindian, and *A. t. tristrami* in the Irano–Turanian and Mediterranean. Some of the localities for *E. b. microlepis* are within the Irano–Turanian, the rest within the Saharo–Sindian. These three lacertids have no conspecific relations in Cisjordan. *O. e. blanfordi* has been collected within the Irano–Turanian and on both its mesic and desertic borders. The related *O. e. ehrenbergi* occurs in the Mediterranean and Irano–Turanian of Cisjordan, and also in the Mediterranean of Transjordan (around Jerash).

The case of *E. s. princeps* is of particular interest since three distinct, apparently allopatric, races of *E. schneideri* occur in Transjordan and adjacent areas (Mertens, 1920, 1924, 1946; Taylor, 1935; Eiselt, 1940). Both localities reported here for *E. s. princeps* are within the Irano–Turanian, and this agrees with this race's general distribution. In the Saharo–Sindian of both Cis- and Transjordan *E. s. schneideri* occurs, while *E. s. pavimentatus* lives in the Mediterranean of Cisjordan. Its occurrence in Transjordan, which is probable, remains to be shown.

The last of the Transjordanian reptiles not occurring in Cisjordan is *Agama blanfordi fieldi* (*A. persica fieldi* Haas and Werner, 1969). This obviously is a Saharo–Sindian, Arabian, form. Its taxonomic relationship with the superficially similar psammophile, *A. savignii* of eastern Egypt, Sinai and southern Cisjordan, has not been studied but the two probably occupy comparable ecological niches.

In conclusion, the locality data presented here for Transjordanian lizards and snakes are in good agreement with a generalized subdivision of Transjordan into three major ecological-biogeographical territories, based on both the maps of Feinbrun and Zohary (1955 : 15) and Poore and Robertson (1964 : 14–15). The species of the Mediterranean territory exhibit no marked morphological deviations from their conspecific counterparts in the Mediterranean of Cisjordan. On the other hand, in several species of desert reptiles (Saharo–Sindian or Saharo–Sindian and Irano–Turanian), the Transjordan population appears to differ from the Cisjordanian one. Furthermore, one Saharo–Sindian species, *Agama blanfordi*, does not occur west of the Rift Valley. Conspicuous is the occurrence in Transjordan of six Irano–Turanian species, of which three do not occur in Cisjordan, while the remaining three are represented there by other (well defined) subspecies (see also Haas, 1952). The reciprocal phenomenon also exists as not all Cisjordanian reptiles occur in Transjordan. Thus among the Saharan psammophile reptiles of southern Cisjordan, five occur only west of the Rift Valley. Another species, *Sphenops sepsoides*, penetrates into the Rift Valley (Werner, 1968), and only one other, *Acanthodactylus scutellatus scutellatus*, is represented east of the Rift Valley by another subspecies, *A. s. hardyi* (northwestern Saudi Arabia—Haas, 1957; Iraq—Haas and Werner, 1969). It is tempting to assume that the Wadi 'Arava, together with the very steep mountain slopes bordering it on the east, constitutes a barrier to the distribution of reptiles, though more direct evidence on this effect would be desirable.

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APPENDIX

LIST OF LIZARDS AND SNAKES SO FAR RECORDED FROM TRANSJORDAN (INCL. WADI 'ARAVA)

The documentation cited in parentheses, for species not represented in this report, is not necessarily the earliest one available. The names listed are not necessarily those employed for the same taxa by the authors cited.

LACERTILIA

GEKKONIDAE

1. *Bunopus blanfordii* Strauch (Barash and Hoofien, 1956)
2. *Ceramodactylus doriae* Blanford (Haas, 1956)
3. *Hemidactylus turcicus turcicus* L.
4. *Pristurus flavipunctatus guweirensis* Haas (Haas, 1951)
5. *Ptyodactylus hasselquistii guttatus* von Heyden
6. *Ptyodactylus hasselquistii puiseuxi* Boutan
7. *Stenodactylus grandiceps* Haas (Haas, 1951)
8. *Stenodactylus sthenodactylus sthenodactylus* Lichtenstein (Haas, 1951)
9. *Tropiocolotes steudneri* Peters (Haas, 1951)

AGAMIDAE

10. *Agama blanfordi fieldi* Haas and Werner
11. *Agama pallida haasi* Werner
12. *Agama sinaita* von Heyden
13. *Agama stellio brachydactyla* Haas
14. *Agama stellio picea* Parker (Haas, 1951)
15. *Agama stellio stellio* L. (Daan, 1967)

CHAMAELEONIDAE

16. *Chamaeleo chamaeleon recticrista* Boettger

LACERTIDAE

17. *Acanthodactylus boskianus asper* Audouin
18. *Acanthodactylus cantoris schmidti* Haas (Hoofien, 1965)
19. *Acanthodactylus grandis* Boulenger
20. *Acanthodactylus robustus* Werner (Haas, 1951)
21. *Acanthodactylus tristrami tristrami* Günther
22. *Eremias brevirostris microlepis* Angel
23. *Eremias guttulata guttulata* Lichtenstein
24. *Eremias guttulata watsonana* Stoliczka? (Wettstein, 1951)
25. *Eremias olivieri schmidti* Haas, (Haas 1951)
26. *Lacerta danfordi danfordi* Günther (Hoofien, 1969)
27. *Ophisops elegans blanfordi* Schmidt
28. *Ophisops elegans ehrenbergi* Wiegmann (Haas, 1951)
29. *Ophisops elegans elegans* Ménétriés (Schmidt, 1939)

SCINCIDAE

30. *Ablepharus kitaibelii* Bibron et Bory (Haas, 1951)
31. *Chalcides ocellatus ocellatus* Forskål
32. *Eumeces schneideri princeps* Eichwald

33. *Eumeces schneideri schneideri* Daudin
34. *Mabuya vittata* Olivier
35. *Ophiomorus latastii* Boulenger (Anderson & Leviton, 1966)
36. *Scincus* sp. (Haas, 1951)
37. *Sphenops sepsoides* Audouin (Werner, 1968)

ANGUIDAE

38. *Ophisaurus apodus* Pallas (Haas, 1951)

VARANIDAE

39. *Varanus griseus griseus* Daudin (Haas, 1951)

OPHIDIA

LEPTOTYPHLOPIDAE

40. *Leptotyphlops phillipsi* Barbour (Haas, 1951)

COLUBRIDAE

41. *Coluber jugularis jugularis* L. (Haas, 1951)
42. *Coluber najadum* Eichwald (Haas, 1951)
43. *Coluber ravergieri nummifer* Reuss (Flower, 1933)
44. *Coluber rhodorhachis* Jan
45. *Coluber rogersi* Anderson
46. *Eirenis collaris* Ménétriés (Haas, 1951)
47. *Eirenis coronella coronella* Schlegel (Schmidt, 1939)
48. *Eirenis coronella fraseri* Schmidt (Haas, 1951)
49. *Eirenis decemlineata* Dumeril & Bibron (Haas, 1951)
50. *Eirenis rothi* Jan (Haas, 1951)
51. *Malpolon moilensis* Reuss
52. *Malpolon monspessulanus insignitus* Geoffroy
53. *Natrix tessellata tessellata* Laurenti
54. *Psammophis schokari* Forskål (Haas, 1951)
55. *Rhynchocalamus melanocephalus* Jan (Hart, 1891)
56. *Spalerosophis diadema* ssp. (Haas, 1951)
57. *Tarbophis nigriceps* Ahl (Haas, 1951)

VIPERIDAE

58. *Cerastes cerastes* L. (Haas, 1951)
59. *Echis colorata* Günther (Haas, 1951)
60. *Pseudocerastes fieldi* Schmidt (Haas, 1951)

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BRITISH 1971 NATURAL

PLATE 1

Agama pallida subspp.:

(A–D) *A. p. haasi* subsp. nov.: (A) Holotype ♂, BM 1965.800, dorsal view; (B) Same, left ear; (C) Juvenile, BM 1965.797, right ear; (D) Paratype ♀, HUJ-R 1884.

(E–F) *A. p. pallida* Reuss: (E) From southern Cisjordan (Wadi Ajram) ♂, HUJ-R 1623; (F) From eastern Egypt (Kassassin) ♂, HUJ-R 1126.

Scale, cm and mm (D–F at same magnification).

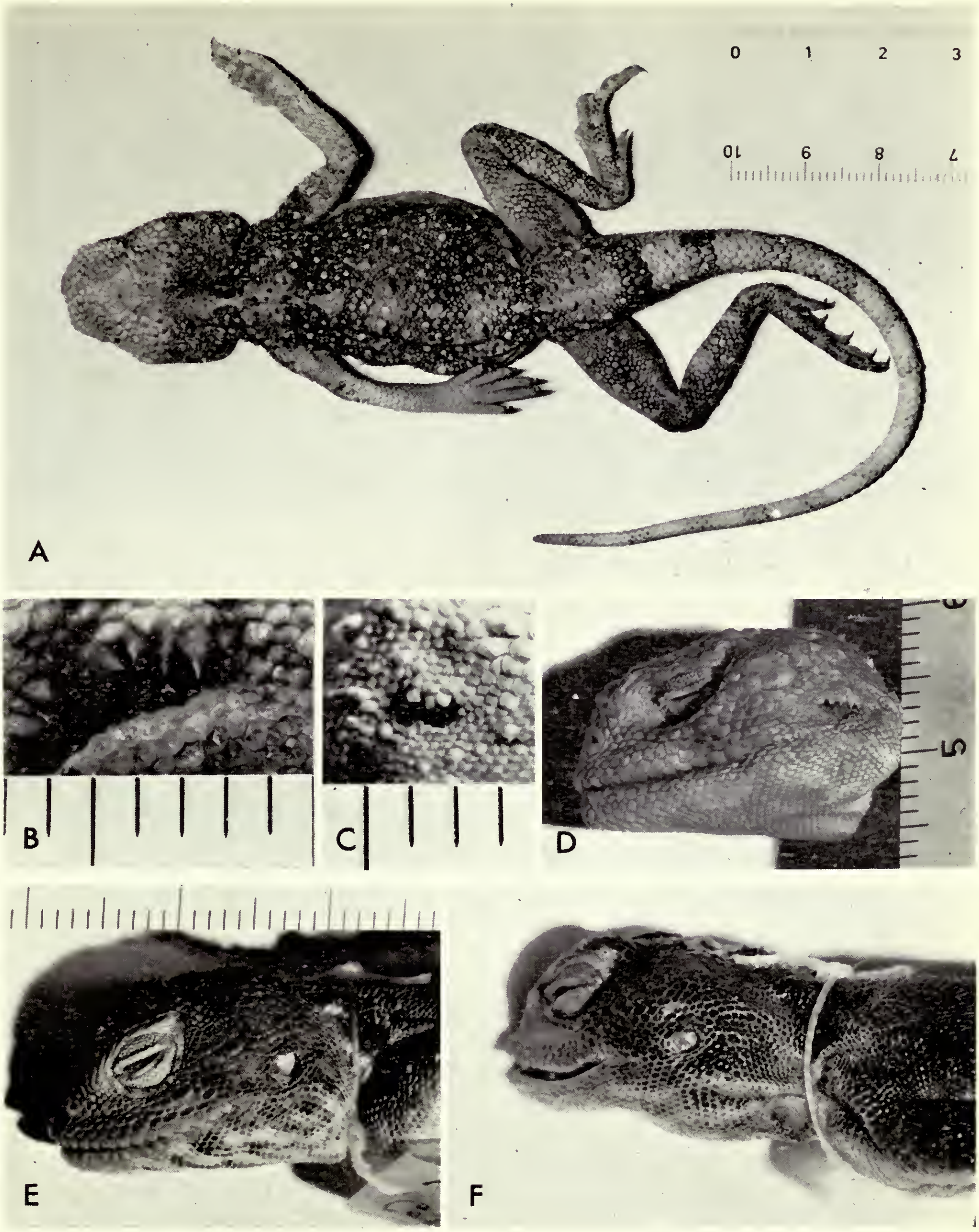
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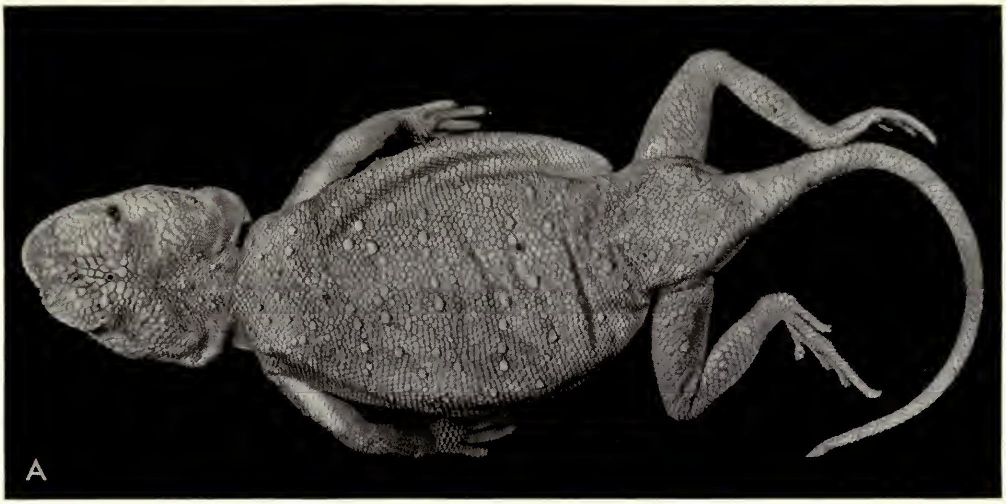
PLATE 2

Agama pallida pallida Reuss holotype ♀, SMF 10007: (A) Dorsal view; (B) Head.


A

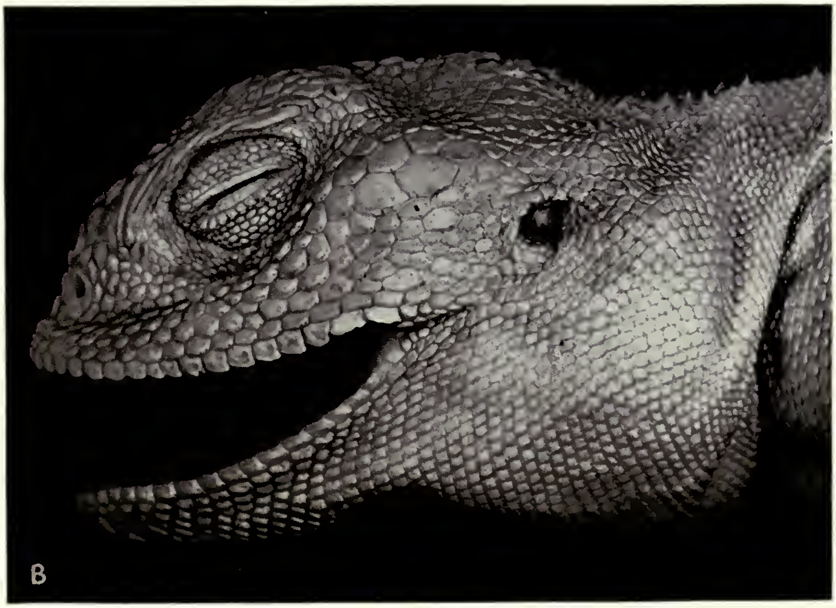

B

PLATE 3

(A) *Agama blanfordi fieldi* ♂, BM 1965.686.

(B–E) *Agama sinaita:* (B) Dorsal view of left pes, and (C) of base of tail, of ♂ from northern Transjordan (Wadi Ratam), BM 1965.685; (D) Dorsal view of left pes of ♀ from southern Cisjordan, HUJ-R 1919; (E) Dorsal view of tail base of ♂ from southern Cisjordan, HUJ-R 1794. Scale, cm and mm (B–E at same magnification).

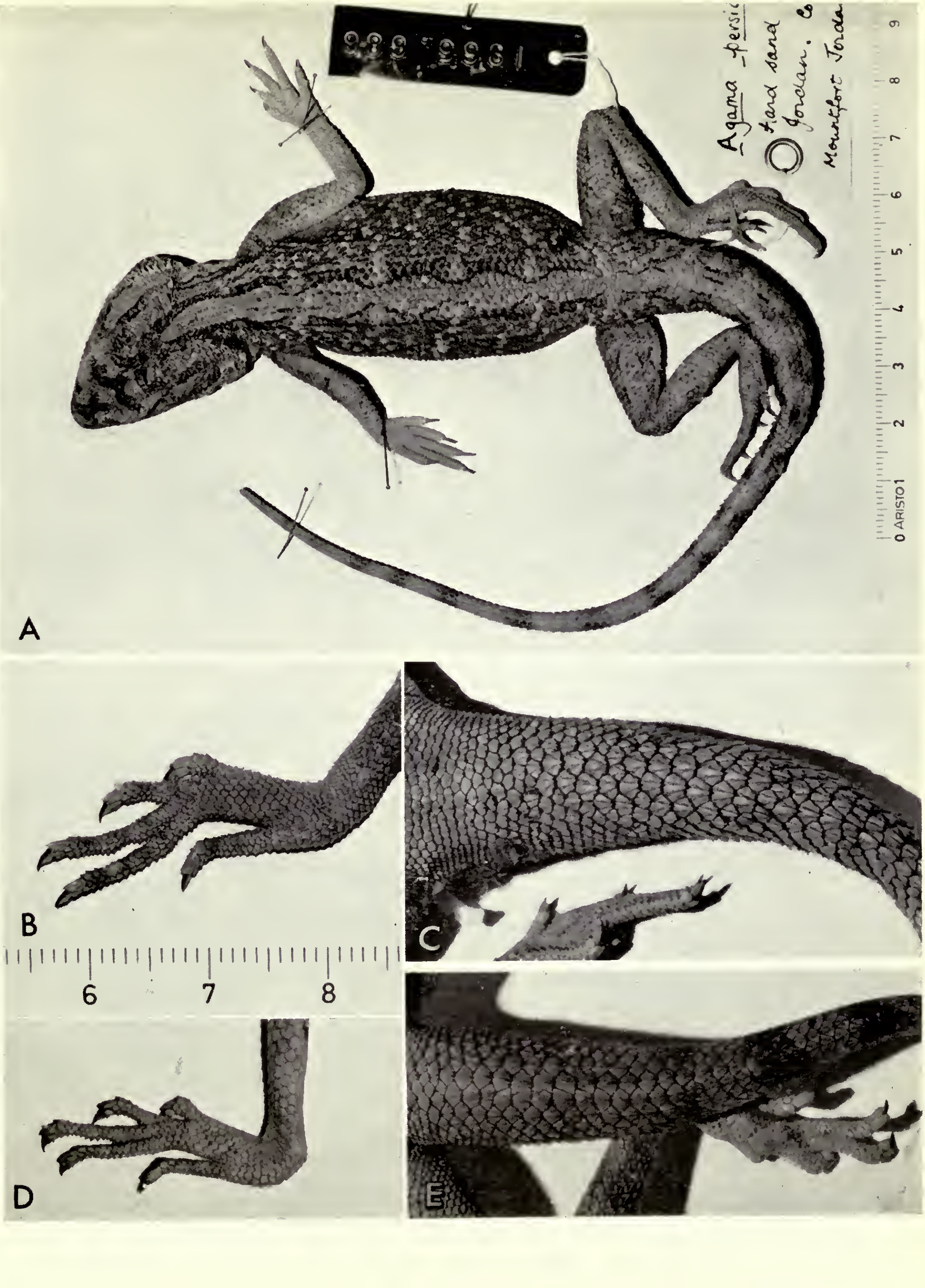

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PLATE 4

(A–B) *Acanthodactylus grandis:* (A) Adult ♀ from Tell el Mukheizin, BM 1965.694; (B) Young ♀ from Ain el Enoquiyya, BM 1965.692.

(C–D) *Acanthodactylus tristrami tristrami:* (C) ♀ from the Jordanian-Syrian border, BM 1962.352; (D) ♂ from 15 Km S of Amman, HUJ-R 1333.

Scale, cm and mm (all at same magnification).

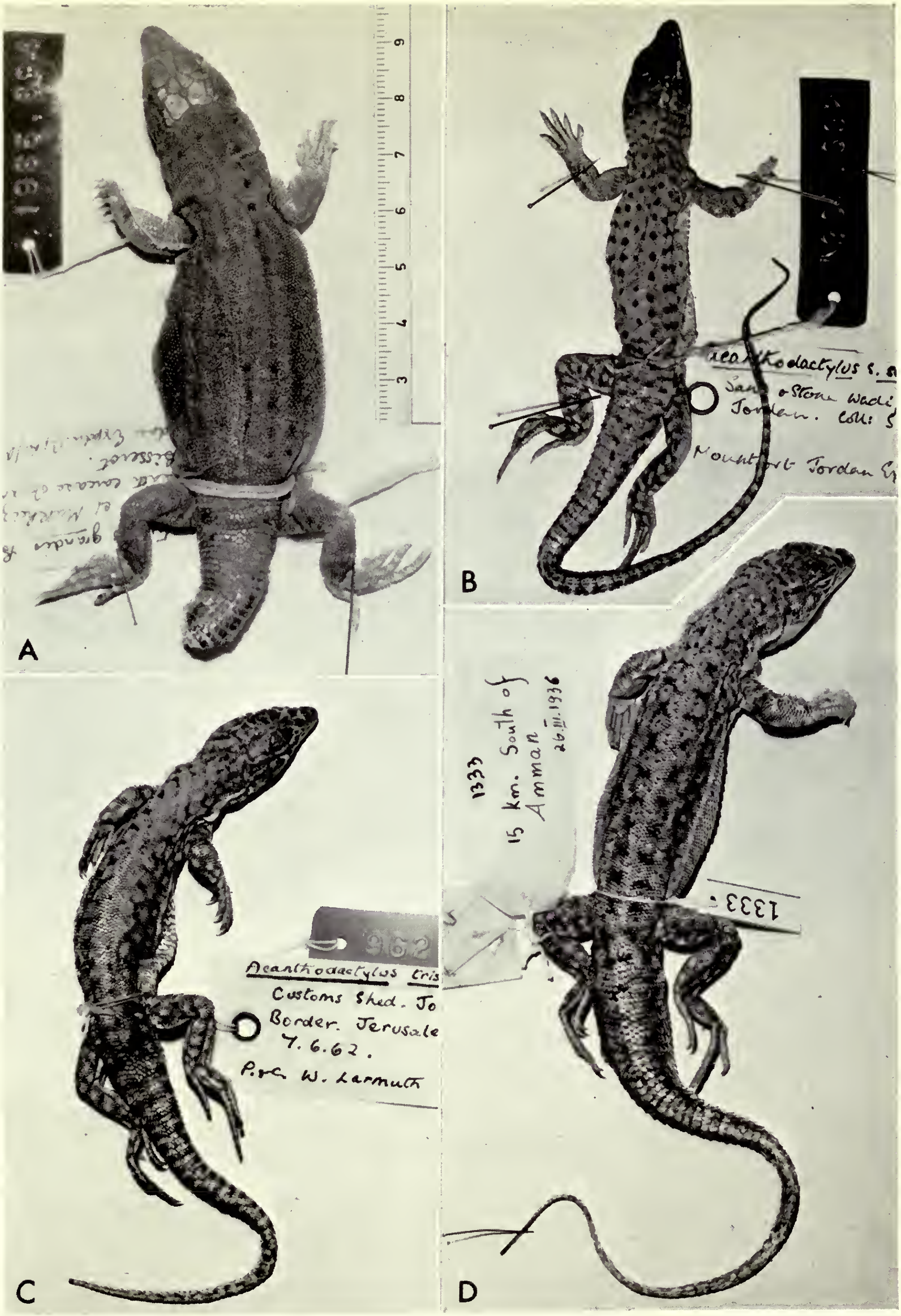
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PLATE 5

Eumeces schneideri subspp.:

(A) *E. s. schneideri* from Petra, BM 1965.786; (B) *E. s. princeps* from Ain el Enoquiyya, BM 1965.695; (C) *E. s. schneideri* from N Shaubak, BM 1963.669.

Scale, cm and mm.

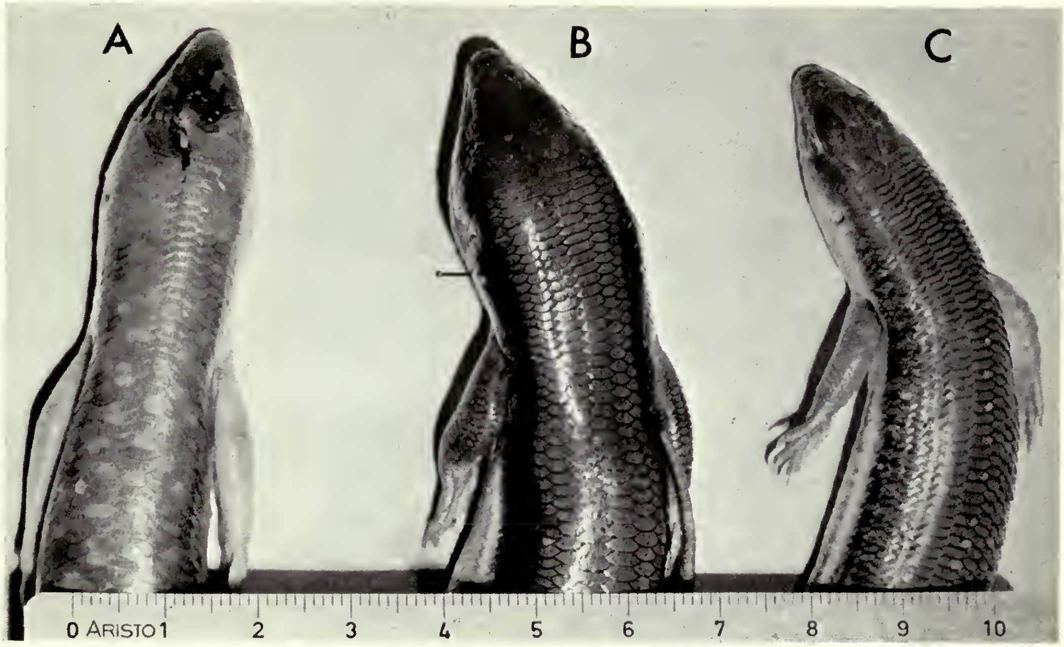
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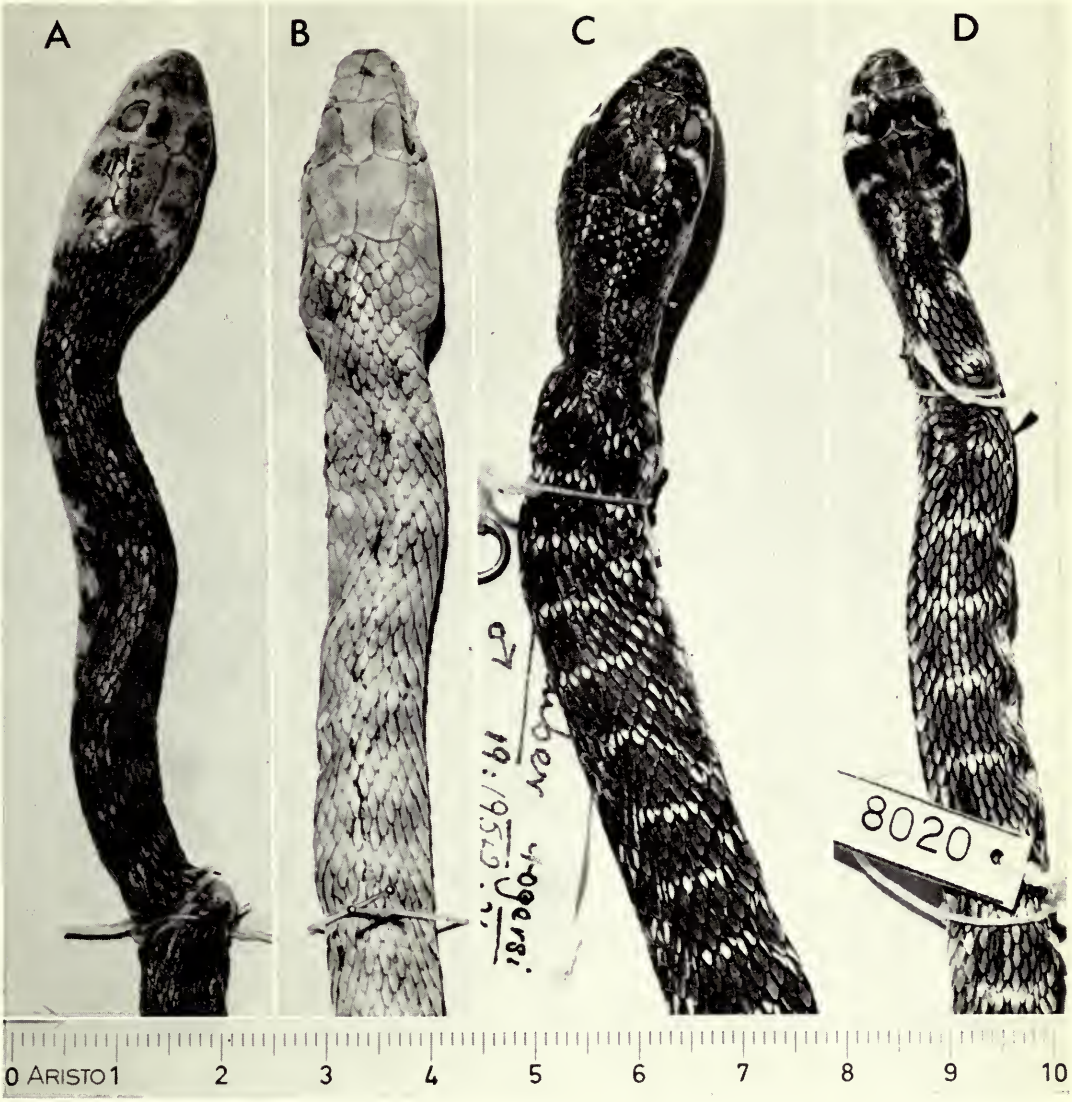
PLATE 6

(A–B) *Coluber rhodorhachis rhodorhachis*: (A) ♀ from Petra, BM 1965.805; (B) ♂ from southern Cisjordan, HUJ-R 3211.

(C–D) *Coluber rogersi:* (C) ♂ from 5 km S of Aseikhim, BM 1965.698; (D) ♀ from southern Cisjordan, HUJ-R 8020.

Scale, cm and mm.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CONCHOECIA FROM THE NORTH ATLANTIC THE 'PROCERA' GROUP

M. V. ANGEL

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ZOOLOGY Vol. 21 No. 7
LONDON: 1971

CONCHOECIA FROM THE NORTH ATLANTIC
THE 'PROCERA' GROUP

BRITISH MUSEUM
8 DEC 1971
NATURAL HISTORY

BY

MARTIN VIVIAN ANGEL
National Institute of Oceanography

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Pp. 257–283; 14 *Text-figures*

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CONCHOECIA FROM THE NORTH ATLANTIC THE 'PROCERA' GROUP

By MARTIN VIVIAN ANGEL

INTRODUCTION

MULLER (1894) decided that *Conchoecia variabilis* Müller 1890 was a confusion of two species, *C. oblonga* Claus 1890 and a new species *C. procera.* Claus (1894) also confused these two species. Later Müller (1906a) further described *C. procera*, and gave its size range as 1·05–1·35 mm for females and 0·85–1·20 mm for males. The geographical range was described as being between 31°N and 35°S in all oceans (Müller 1906a, b, 1908, 1912). It has since been further reported in the North-eastern Atlantic (Fowler 1909, Granata & Caporiacco 1949, Angel 1968, 1969a, b), the Sargasso Sea (Deevey 1968), the Benguela Current (Iles 1953), western Mediterranean (Leveau 1965), the Adriatic (Schweiger 1912, Huré 1955, 1961), the western Indian Ocean (Leveau 1967, 1968), the eastern Indian Ocean (McKenzie in press).

In 1968 R.R.S. 'Discovery' took a series of hauls in the region of 11°N 20°W, about 300 miles south of the Cape Verde Islands, to study vertical distribution patterns. It was soon apparent that adult specimens attributable to *C. procera* separated into three distinct size groupings, which showed differential depth distributions; Deevey (1968) also noted two size groupings. The middle sized group, the most abundant, is considered here to be synonomous with *C. procera sensus strictu.* The morphological differences between this group and the smaller and larger groups are sufficiently great to attribute them with specific status. They are, therefore, named *Conchoecia microprocera* sp. nov. and *Conchoecia macroprocera* sp. nov. respectively.

A single adult female taken in a deep vertical haul at 'Discovery' station 4768 in 1961 near 40°N 20°W, is also described and is ascribed to *C. vitjazi* Rudjakov 1962, another species which possibly belongs to the '*procera*' group.

Conchoecia procera Müller 1894

MALE. *Carapace.* The lengths of 234 specimens from 11°N 20°W ranged from 0·98–1·04 mm with a mean of 1·020 ± 0·019 mm, and of 70 specimens from off the Moroccan coast 34°N 8°W (Angel 1968) ranged from 0·96–1·04 mm with a mean of 1·005 ± 0·009 mm. The outline of the carapace (fig. 1A, B) with the smooth curve of the posterior edge into the ventral edge broken only by the step at the opening of the right asymmetrical gland is similar to Müller's figure (1894 T. XIII fig. 39). Similarly the shape of the posterior dorsal spine (fig. 3F) is identical to Müller's figure (1894 T. XIII fig. 41) and is the character by which he separated *C. procera* from *C. decipiens* Müller in his key (Müller 1912). Edge glands are numerous down the posterior carapace margin, and are present but less abundantly along the

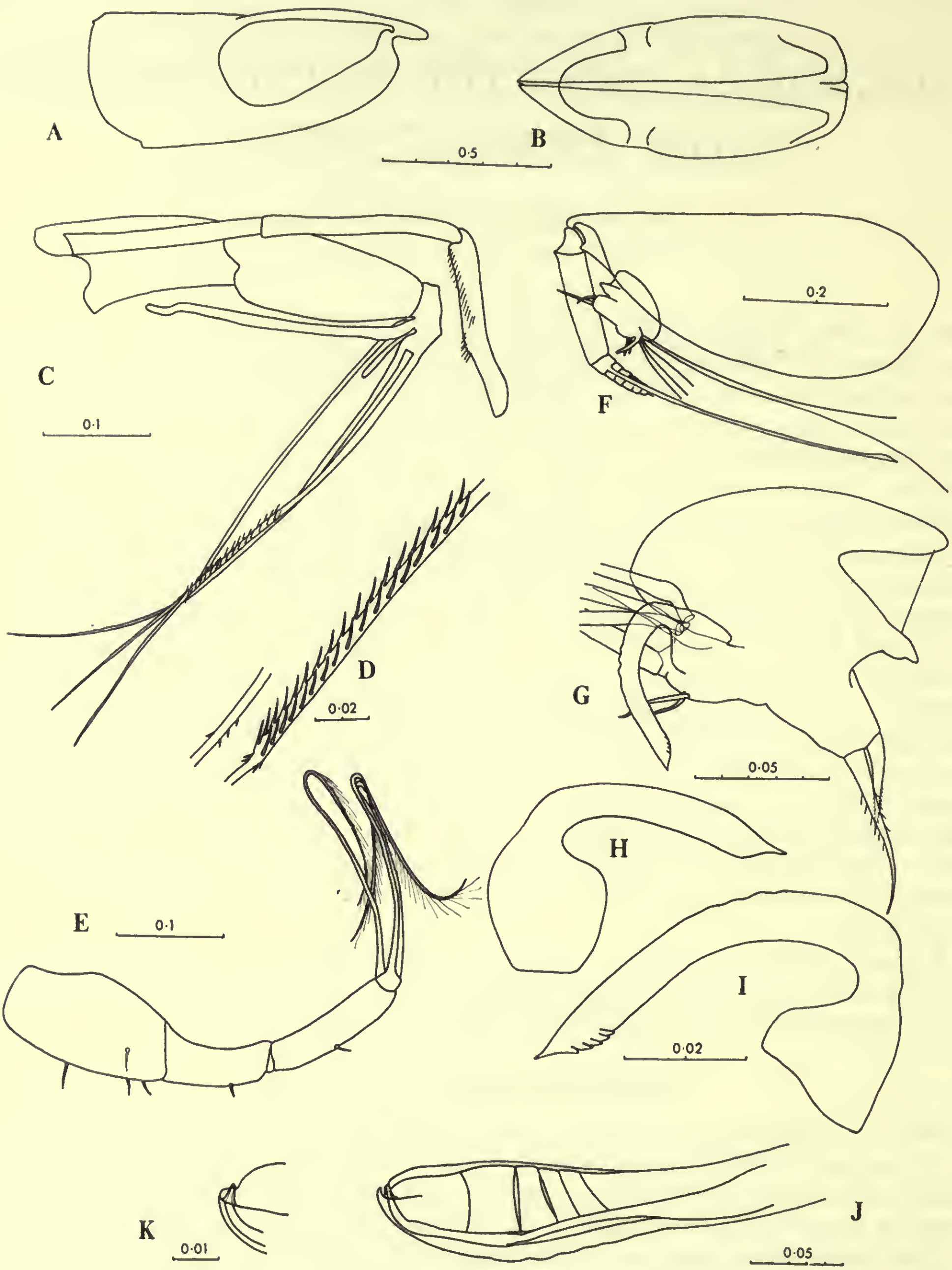
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FIG. 1. *Conchoecia procera* Müller, male. A, Lateral view of carapace; B, Ventral view of carapace; C, Frontal organ and first antenna; D, Armature of the b and e setae of the first antenna; E, sixth limb; F, second antenna; G, endopodite of the right second antenna; H, left hook appendage; I, right hook appendage; J, penis; K, detail of tip of penis.

ventral margin. Live animals have not been observed to bioluminesce.

Frontal organ (fig. 1C). The shaft reaches level with the end of the limb of the first antenna. The capitulum is downturned and slightly curved. There is a small ventral swelling about half way along its length.

First antenna (fig. 1C). The first segment is shorter than the second. None of the segments carry any additional armature. The **a** seta is almost as long as the limb, reaching well beyond the joint between the first and second segments. The **c** seta is very short. The remaining three setae are almost equal with the **e** seta just the longest. The **d** seta is bare but the **b** seta has three small spines opposite the distal end of the **e** seta armature. The **e** seta has about seventeen pairs of long slender spines (fig. 1D) with two pairs of distally pointing spinules just distal of the main armature. The main spines decrease in length slightly towards the base of the seta.

Second antenna (fig. 1F). The exopodite segments carry no unusual armature. The protopodite is a little less than half the carapace length and the first exopodite segment is about 3/8's its length. On the endopodite (fig. 1G) the processus mamillaris is blunt with a small rounded tubercle slightly offset to one side. The **a** seta which carries fine spinules, is half the length of the **b** seta. The **b** seta is armed with much longer and stronger spines. The **c** and **d** setae are almost as long as the second segment, while the **e** seta is a minute spine. The **f** seta is only slightly shorter than the **g** seta, and both setae are thin walled terminally and unarmed. The **h, i** and **j** setae are short with barely developed shafts, but the **h** seta does have a small basal swelling. The left hook appendage (fig. 1H) curves through about 120°, terminally tapering into a smooth point. The right hook appendage (fig. 1G) is larger and slightly more curved. It is slightly swollen and ridged subterminally and ends in a point.

Mandible (fig. 2C). There is only a single long seta on the inner surface of the first endopodite segment, and there is no additional armature on any of the other endopodite segments. The toothed edge of the basale (fig. 2B) is typical for the genus with two tubiform teeth, six serrate teeth and an outer tooth which is unusually broad in this species. One of the outer setae is long, but the other only reaches level with the teeth. There are long hairs on the outer surface arranged in four rows, two leading up to the bases of the spine teeth. The outer teeth have very clear secondary tooth rows. The toothed edge of the coxale has ten teeth (fig. 2A). The distal tooth list consists of two large teeth, neither of which is serrate, and ten to twelve small teeth, the outermost of which is broad. The proximal list consists of 13–15 fairly regular teeth which decrease in size along the list.

Maxilla (fig. 2D). There is a basal seta. The first endopodite segment has six anterior, one lateral and three posterior setae. There is no distal armature on the first segment.

Labrum (fig. 2E). The hyaline membrane has a smooth rather shallow notch.

Caudal furca (fig. 2G). There is no unpaired seta dorsal to the eight pairs of hook spines. There is a covering of fine hairs between the caudal lamellae.

Penis (figs 1J, K). The intromittent organ has five oblique muscles. The end of the organ is rounded in outline.

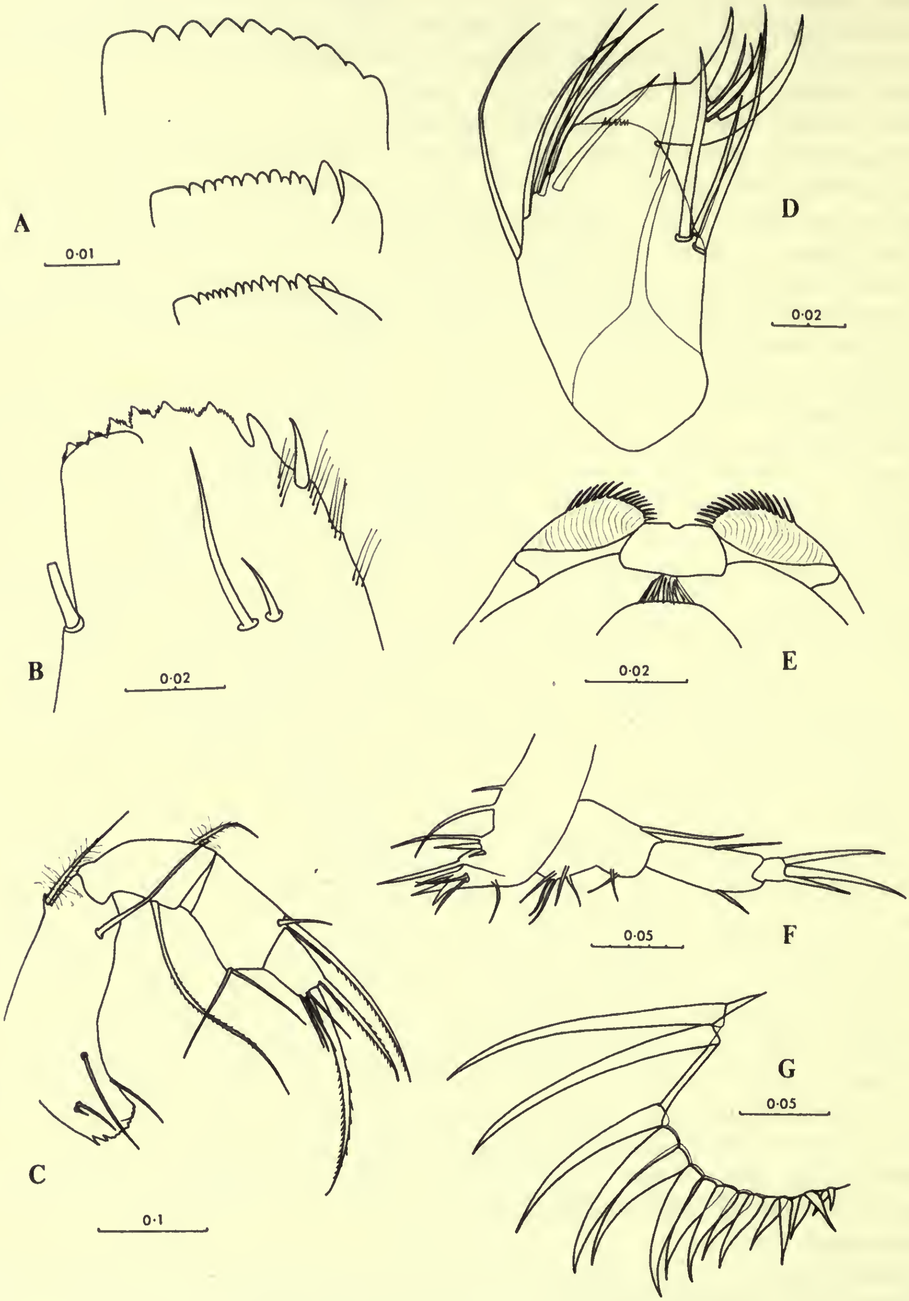
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FIG. 2. *Conchoecia procera* Müller. A, mandible tooth list and toothed edge of the coxale; B, mandible toothed edge of the basale; C, mandible endopodite; D, maxilla endopodite; E, labrum; F, fifth limb; G, caudal furca.

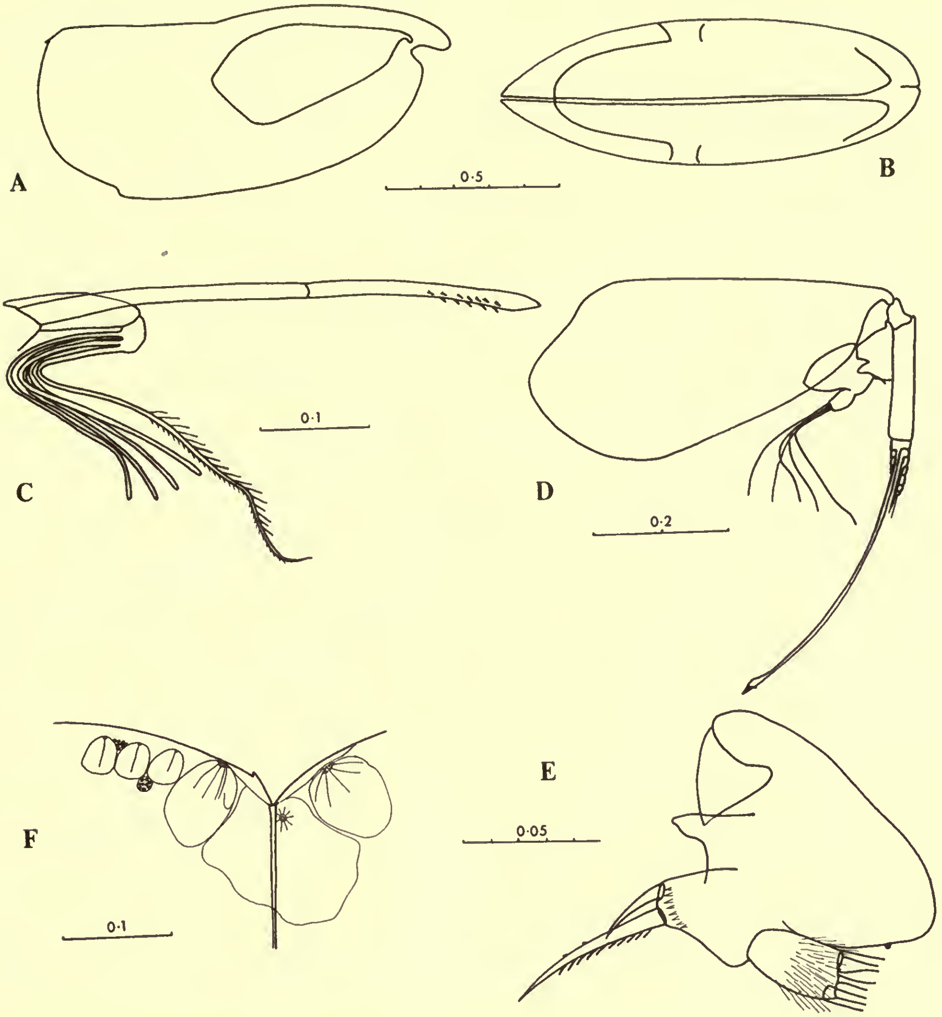

FIG. 3. *Conchoecia procera* Müller, female. A, lateral view of carapace; B, ventral view of carapace; C, frontal organ and first antenna; D, second antenna; E, second antenna endopodite; F, male detail of the posterior dorsal corner of the carapace.

FEMALE. *Carapace* (figs 3A, B). The lengths of 282 specimens from 11°N ranged from 1·12–1·24 mm with a mean of 1·181 ± 0·021 mm. 122 specimens from off the Moroccan coast ranged from 1·12–1·24 mm with a mean of 1·166 ± 0·022 mm. The change in the mean size with latitude is insignificant.

Frontal organ (fig. 3C). The capitulum is not differentiated from the stalk. The total length is about three times the length of the limb of the first antenna It has a slight terminal swelling with a rounded knob. There are spines on its underside.

First antenna (fig. 3C). There is no additional armature. The **a–d** setae are thin walled and a little longer than the length of the limb. The **e** seta is nearly twice as long as the other setae and distal of their ends it carries long fine spinules on the anterior edge and shorter spinules on its trailing edge.

Second antenna (fig. 3D). The protopodite is 2/5's the length of the carapace and nearly three times the length of the first exopodite segment. The longest swimming seta is 3/4 the length of the protopodite. On the endopodite (fig. 3E) the **a** seta is bare and less than half the length of the **b** seta. The **b** seta carries 8–9 strong spinules. On the segment near the bases of the **a** and **b** setae are about eight small spines. The second segment carries many long fine hairs (c.f. Müller 1894 T.6 fig. 61). The **c, d** and **e** setae are all absent. All the main setae are thin walled. The **g** seta is distinctly broader but only slightly longer than the other four subequal setae.

Synonomy. There is no clear type locality for this species. Müller (1890) described *C. variabilis* which he later (1894) decided was a confusion between *C. oblonga* Claus and *C. procera*, from the Pacific and also from the Gulf of Naples. Claus's (1894) material described as *C. oblonga* Claus included *C. procera* Müller (Müller 1906a) came from the eastern Mediterranean. It is not until Müller's (1894) original description of *C. procera* that any certainty can be attached to the identifications. However, there are no localities given for any of the material. From Leveau's (1965) rather sparse data and some specimens from the North Adriatic sent to me by Professor J. Stirn it has been possible to confirm the presence of *C. procera sensu strictu* in the Mediterranean. Müller's (1906a) material included at least one if not both of the new species described below, judging from his data on size ranges and the armature of the male antennular **e** seta. Fowler (1909) appeared only to have caught *C. procera sensu strictu* from the Bay of Biscay. Deevey (1968) reported two forms of *C. procera*, the larger of which conformed with the description above of *C. procera sensu strictu*. A re-examination of Angel's material from the Moroccan coast (1968) and from near Fuerteventura in the Canary Islands (1969a) showed that they all beonged to *C. procera sensu strictu*, with the single exception of the one adult female caught above the thermocline at 'Discovery' station 6183 haul 2. This specimen corresponded to the new species described below *C. microprocera*.

Conchoecia microprocera sp. nov.

MALE. The holotype mounted on slides in Euparal and stained with lignin pink has been deposited in the British Museum (Natural History), No. 1971.2.1.1. Locality 'Discovery' station 6665 haul 4, 10°32.7'N, 19°57.4'W. Depth 400–295 m. Time 1559–1731 hrs. Date 22 February 1968. Net Modified Indian Ocean Standard Net (N113) fitted with a catch dividing bucket (Foxton 1963, 1969).

Carapace (figs 1A, B). The range in length of 204 specimens was 0·82–0·92 mm with a mean of 0·863 ± 0·013 mm. The height and breadth of the carapace were both approximately 2/5's the length. In *C. procera sensu strictu* the carapace height was always measurably larger than its breadth (Table 1). There was a small

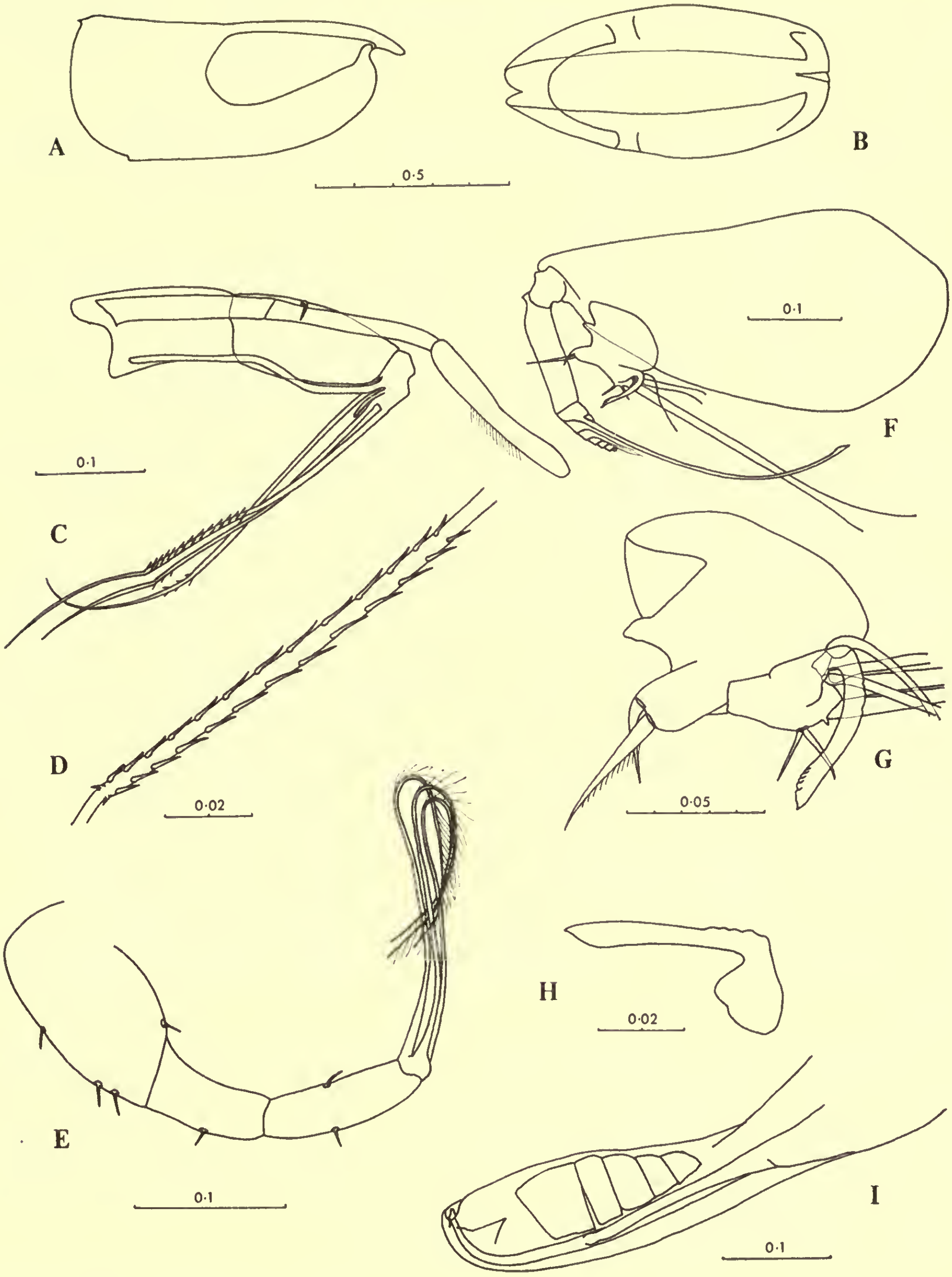
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FIG. 4. *Conchoecia microprocera* sp. nov., male. A, lateral view of carapace; B, ventral view of carapace; C, frontal organ and first antenna; D, first antenna armature on e seta; E, sixth limb; F, second antenna; G, endopodite of the right second antenna; H, left hook appendage; I, penis.

spine on the right valve at the posterior dorsal corner (fig. 6F). The asymmetrical glands and the edge glands are very similar in their positions to *C. procera sensu strictu.*

Frontal organ (fig. 4C). The stalk projects just beyond the length of the first antenna. The capitulum is long and slender and curves slightly downwards. Terminally it is rounded. There is a patch of fine long hairs in the centre of the ventral surface.

First antenna (fig. 4C). There is no additional armature. The first and second segments are subequal, and there are large pigment corpuscles in the region of their articulation. The **a** seta lies back parallel with the limb and reaches almost to the base. It is relatively longer than in the other two species (Table 1). The **c** seta is extremely short. The **b** and **d** setae are subequal, only slightly shorter than the **e** seta. Both carry very fine spinules on a level with the distal end of the **e** seta armature. The **e** seta armature (fig. 4D) consists of 11–13 pairs of spines which increase very slightly in length towards the base of the seta. Beyond these main spines are two pairs of distally pointing spinules. Deevey (1968) described some of her specimens of *C. procera* as having this type of armature.

Second antenna (fig. 4F). The protopodite is more than half the length of the carapace, and this distinguishes this species from the others (Table 1). The first exopodite segment is a third the length of the protopodite and twice the lengths of the remaining exopodite segments. The longest swimming seta is about 4/5's the length of the protopodite. There is no additional armature on the exopodite segments. On the endopodite (fig. 4G) the processus mamillaris has a very bluntly pointed tip. The **a** seta is bare and half the length of the **b** seta. The **b** seta carries spinules for most of its length. The **c** and **d** setae are almost as long as the second segment. The **e** seta is a minute spine. The **g** and **f** setae are bare, terminally thin walled, blunt and slightly flattened. The **h, i** and **j** setae are short with very poorly developed shafts. The left hook appendage (fig. 4G) is right angled at its base, and then distally straight. It broadens near its end and then tapers to end in a smooth curved point. The right hook appendage (fig. 4H) is longer beyond the basal angle, and curves to terminate in a curved point with marked subterminal ridging.

Mandible (fig. 5C). The toothed edge of the basale is the usual structure for the genus (fig. 5B). The outer two setae are very short not reaching level with the teeth. There are fine hairs on the outer surface, with two rows running up to the bases of the tubiform teeth. There are no hairs on the basale between the toothed edge and the articulation with the first endopodite segment. On the first endopodite segment there are two setae on the inner edge; one very long, the other minute. The terminal claw seta is particularly long.

The toothed edge of the coxale (fig. 5A) has ten teeth. The distal tooth list consists of two large teeth, neither serrate, followed by 13–14 small regularly sized teeth. The proximal list consists of 15 irregular teeth.

Maxilla (fig. 5D). There is a basal seta. There are three posterior setae and a lateral seta on the first segment, but there are only five anterior setae compared

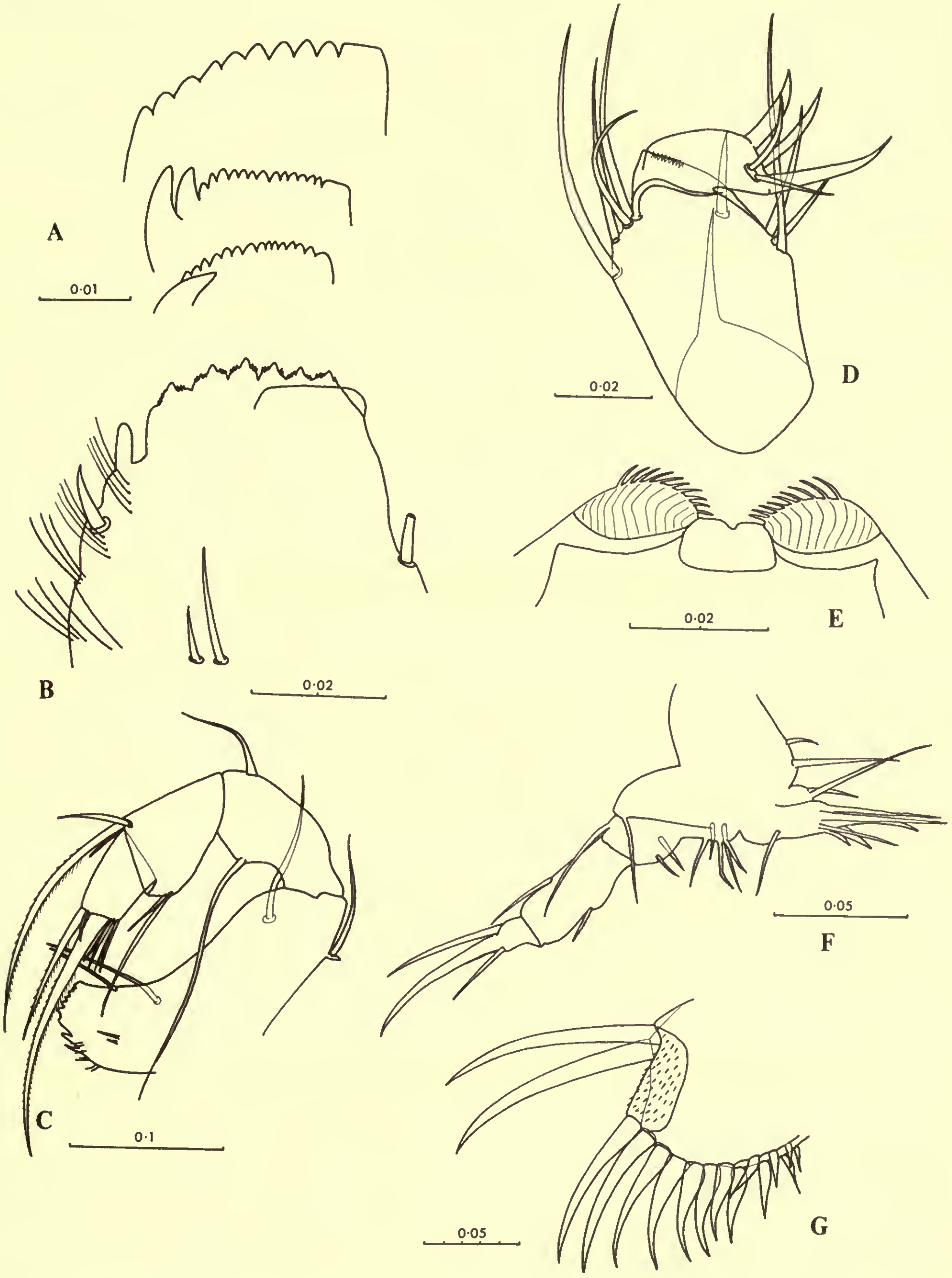
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FIG. 5. *Conchoecia microprocera* sp. nov. A, mandible tooth lists and toothed edge of the coxale; B, mandible toothed list of the basale; C, mandible endopodite; D, maxilla endopodite; E, labrum; F, fifth limb; G, caudal furca.

with six in the other species of the '*procera*' group. There is a row of fine spinules on the distal edge of the first endopodite segment.

Labrum. There is a shallow smooth notch in the hyaline membrane.

Penis (fig. 4I). There are four oblique muscles. The terminal incurved end plate has two small spines.

Caudal furca (fig. 5G). There is no unpaired seta dorsal of the hook spines. There are fine hairs between the two caudal lamellae which are most clearly seen between the bases of the first and second hook spines.

FEMALE. The paratype specimen mounted on slides in Euparal and stained with lignin pink has been deposited in the British Museum (Natural History) No. 1971.2.1.2 The collection data is as for the male.

Carapace (figs 6A, B). The range in length of 260 specimens was 0·92–1·06 mm with a mean of 0·999 ± 0·023 mm. The general appearance was more hyaline than for the other closely related species. It is slimmer in appearance, but the tendency for the animals to splay open on preservation probably contributed to the insignificance in the difference between its relative breadth and those of the other species. The openings of the various glands were similar to those of the other species. The spine on the right valve at the posterior dorsal corner is well developed.

Frontal organ (fig. 6C). The frontal organ shows some evidence of differentiation into stalk and capitulum. The capitulum is a little broader and is swollen towards its tip finally ending in a down curved point.

First antenna (fig. 6C). There is no dorsal seta or other additional armature. The **a–d** setae are only half the length of the **e** seta. Distal of their ends the **e** seta carries short spinules on its posterior edge and sparse long hairs on its anterior edge.

Second antenna (fig. 6D). The protopodite is much longer relative to the carapace than in the other species (Table 1). There is no unusual armature on the exopodite. On the endopodite (fig. 6E) the processus mamillaris is rounded. The **a** seta is half the length of the **b** seta and carries very fine spinules. The **b** seta has four to six stouter spinules, and it curves into a long tapering point. On the segment near the bases of these two setae are four spines which are much longer than in the other two species. The **c, d** and **e** setae are absent. The main setae are all thin walled and bare. The **g** seta is only a little longer than the others but appreciably broader.

Synonomies. It is clear from Deevey's (1968) account that her material included specimens of this species; both from the size ranges and the number of spines in the armature of the **e** seta of the male antennule of her specimens described as *C. procera* Müller. No other authors give sufficient information to determine the full range of this species. Müller (1906a) also confused this species with *C. procera.* A re-examination of material from the Moroccan coast (Angel 1968) showed that the single adult female caught above the thermocline at 'Discovery' station 6183 haul 2 (34°14·5'N, 08°03·0'W) belonged to this species. Recently more specimens were taken in the vicinity of 17°45'N, 25°30'W (Angel unpublished).

Table 1

Some meristic characters of five of the species belonging to the 'procera' group. All measurements other than carapace length are expressed as percentage of the carapace length, and are based on measurements of twenty specimens where standard deviations are given. The lengths of *C. procera* in parenthesis are for specimens from the Moroccan coast region

	C. microprocera sp. nov.		*C. procera* Müller		*C. macroprocera* sp. nov.		*C. decipiens* Müller		*C. vitjazi* Rudjakov
	♂	♀	♂	♀	♂	♀	♂	♀	♀
Range	0·82–0·92	0·92–1·06	0·98–1·06	1·12–1·24	1·10–1·22	1·26–1·36	1·24	1·40	2·00
Mean length	0·863±0·013	0·999±0·023	1·022±0·019 (1·005±0·009)	1·181±0·021 (1·166±0·022)	1·153±0·021	1·304±0·021	—	—	—
No.	204	260	234 (70)	282 (122)	207	263	1	1	1
Height	41·95±1·14	42·63±1·08	42·86±0·81	43·80±0·98	40·58±1·19	40·65±1·05	46·55	45·83	(∼50)
Breadth	41·61±1·09	34·52±1·18	41·53±1·24	36·57±1·05	43·80±0·86	36·65±0·90	—	35·42	—
F.O. Capit.	18·70±0·80	34·41±0·91	16·08±0·61	37·41±0·90	16·80±0·49	38·51±0·99	15·19	34·81	37·43
Shaft	40·70±0·73		35·44±0·75		35·01±0·82		38·79		
Ant 1 Segt. 1	18·63±0·40	—	16·20±0·38	—	14·83±0·40	—	17·24		
,, 2	18·52±0·30	—	16·65±0·46	—	16·92±0·39	—	18·10		
Total	40·15±0·73	15·65±0·85	35·39±0·80	12·65±0·40	35·18±0·66	14·09±0·34	39·66	20·00	13·90
a seta	27·67±1·25	16·71±0·46	22·73±0·88	17·65±1·02	21·86±0·97	17·32±0·56	20·47	13·89	21·39
b ,,	45·14±0·95		42·48±1·03		43·34±0·88		45·04		
c ,,	4·62±0·23		5·24±0·49		5·23±0·31		7·54		
d ,,	45·40±0·79		42·29±1·06		43·57±1·01		45·26		
e ,,	46·38±1·05	32·06±0·84	44·42±1·05	31·91±0·67	46·62±1·08	32·24±0·80	46·12	30·37	42·78
Spines	(2+)11–13×2		(2+)16–18×2		(1+)28–32×2		2×29		
Ant 2 Protop.	51·93±0·74	45·43±0·78	46·61±1·04	41·51±0·75	46·34±0·68	41·43±0·56	50·00	41·85	39·04
Exop. 1	17·21±0·30	16·12±0·30	17·09±0·53	15·34±0·38	16·61±0·41	14·98±0·30	17·24	14·81	22·99
,, 2–8	8·68±0·30	7·72±0·23	7·41±0·20	6·49±0·16	8·12±0·15	7·17±0·09	8·62	8·15	8·02
LSS	41·34±1·63	34·49±1·05	37·64±1·07	32·86±0·88	41·74±1·28	34·34±0·80	39·66	34·07	50·80
g seta	42·07±1·30	16·95±0·43	39·80±1·42	19·81±0·81	43·73±1·26	20·01±0·52	44·83	24·44	43·85
f ,,	36·12±1·59	14·97±0·93	34·88±1·64	15·83±0·50	38·54±1·23	15·82±0·53	35·34	16·30	35·29
h, i, j setae	10·09±0·56		9·53±0·44		9·27±0·51		10·78	14·07	31·01

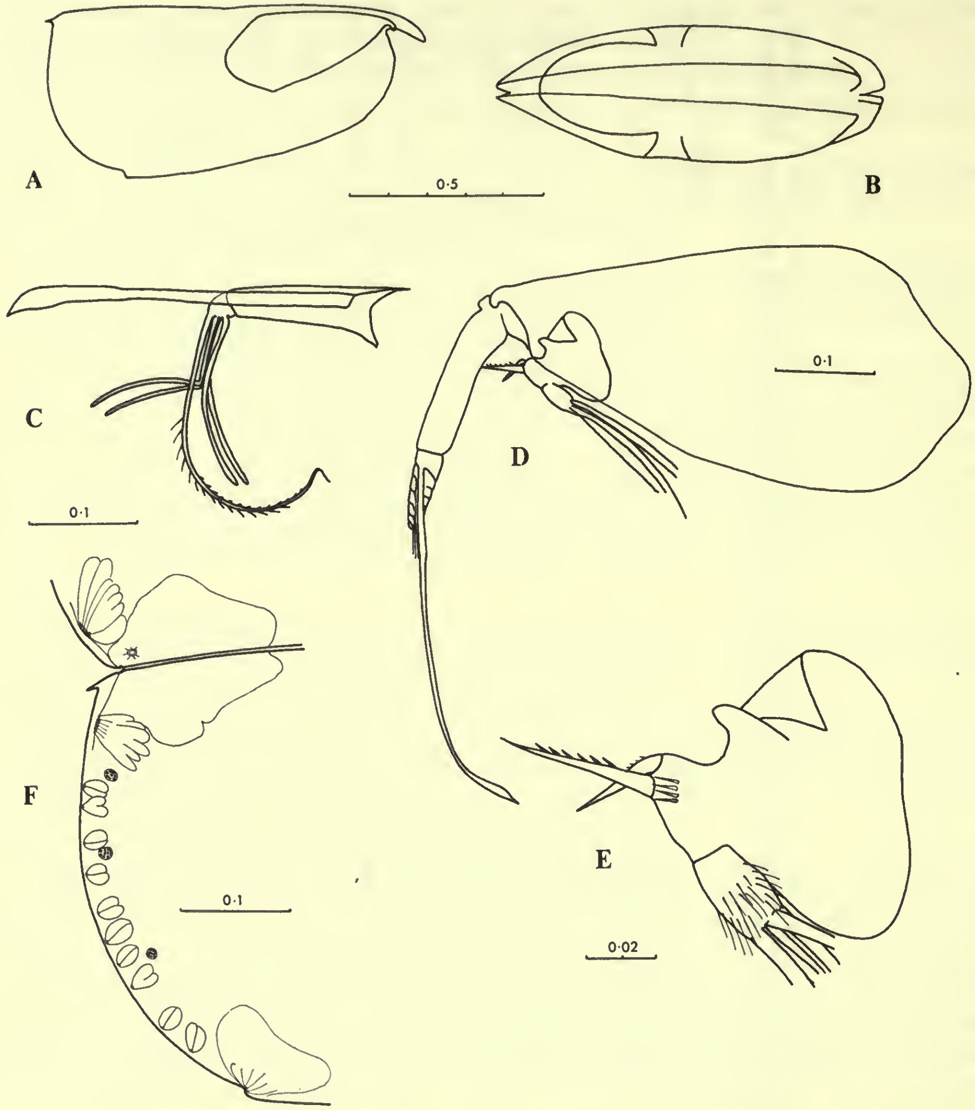

FIG. 6. *Conchoecia microprocera* sp. nov., female. A, lateral view of carapace, B, ventral view of carapace; C, frontal organ and first antenna; D, second antenna; E, second antenna endopodite; F, male detail of the posterior dorsal corner of the carapace.

Conchoecia macroprocera sp. nov.

MALE. The holotype specimen mounted on slides in Euparal and stained with lignin pink has been deposited in the British Museum (Natural History) No. 1971.2.1.3. Collection data as for *C. microprocera* sp. nov. (see above).

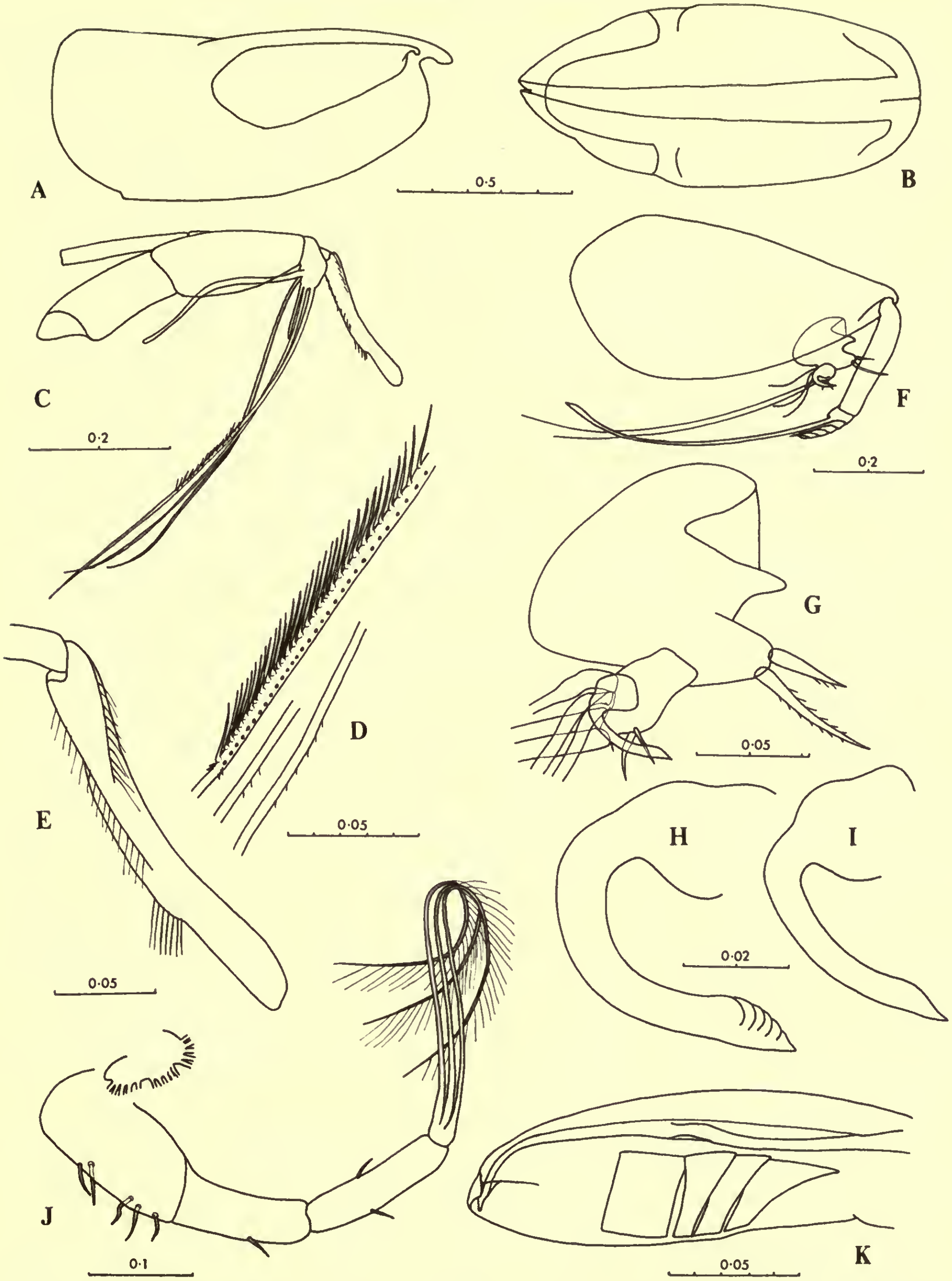
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FIG. 7. *Conchoecia macroprocera* sp. nov., male. A, lateral view of carapace; B, ventral view of carapace; C, frontal organ and first antenna; D, first antenna detail of armature of the e, d and b setae; E, frontal organ capitulum; F, second antenna; G, left second antenna endopodite; H, right hook appendage; I, left hook appendage; J, sixth limb; K, penis.

Carapace (fig. 7A). The range in size of 207 specimens was 1·10–1·22 mm with a mean of 1·153 ± 0·021 mm. The relative height tended to be less and the breadth greater than for the other species. However, a distinguishing feature is that in all specimens the carapace breadth was greater than the height. The openings of the various glands are as described in the other species. There is no spine on the right valve at the posterior dorsal corner (fig. 9F) (c.f. Müller 1906a T. XIII fig. 37).

Frontal organ (fig. 7C). The shaft reaches level with the end of the limb of the first antenna. The capitulum is long and down turned. Two lateral thickening bars carry fine long hairs for the proximal third. The ventral edge has a small swelling on its median third, on the distal end of which is a more obvious group of long hairs. The dorsal edge is concave and bare. The end of the capitulum is rounded with a low subterminal knob (fig. 7E). One of Müller's figures (1906a T. XIII fig. 45) shows some resemblance to the frontal organ of this species.

First antenna (fig. 7C). The first segment is much shorter than the second; contrasting with the other two species. The ganglionic body, which lies in the region of the articulation between the two segments contains many yellow brown pigment corpuscles. The **a** seta lies back parallel with the limb reaching beyond the end of the second segment. The seta is significantly shorter than in *C. microprocera*, but not significantly so than in *C. procera* Müller. The **b** and **d** setae are sub-equal and only carry six and three minute spinules respectively on a level with the distal end of the **e** seta armature. The **e** seta armature (fig. 7D) consists of 28–30 pairs of long slightly curved spines which increase in length slightly towards the base of the seta. Distal of the main armature are two pairs of distally pointing spinules.

Second antenna (fig. 7F). The relative lengths of the protopodite and exopodite are similar to those in *C. procera* Müller. The longest swimming seta is longer and more closely approaches the protopodite length than in the other species. The **a** seta on the endopodite (fig. 7G) is 2/3's the length of the **b** seta and has a few very fine spinules. The **b** seta carries more longer spinules. The **c** and **d** setae are nearly as long as the second segment. The **e** seta is minute. The **g** seta is only a little longer than the **f** seta. Both the **g** and **f** setae are bare and the **g** seta is slightly flattened. The **h** seta has a slight swelling near its base. The left hook appendage (fig. 7I) has a basal right angle and then curves gently a further 30° or so. Terminally it tapers asymmetrically to a blunt point. The right hook appendage (fig. 7H) curves through a total of 150°. The end is swollen with subterminal ridging and ending in a blunt asymmetrical point.

Mandible (fig. 8C). The toothed edge of the coxale (fig. 8A) has ten low blunt teeth. The distal tooth list consists of two large teeth, the second of which is serrated, followed by about twelve small regularly sized teeth. The proximal list has twelve to fifteen teeth regularly diminishing in size across the list.

The toothed edge of the basale (fig. 8B) consists of the usual two tubiform followed by six wedge teeth with a single broad outer tooth. The outer setae are short and fail to reach the level of the teeth. There are five rows of hairs arranged on the surface between the insertion of the outer setae and the two tubiform teeth. On the inner edge of the first endopodite segment is a single long seta. The second segment is bare on its outer edge.

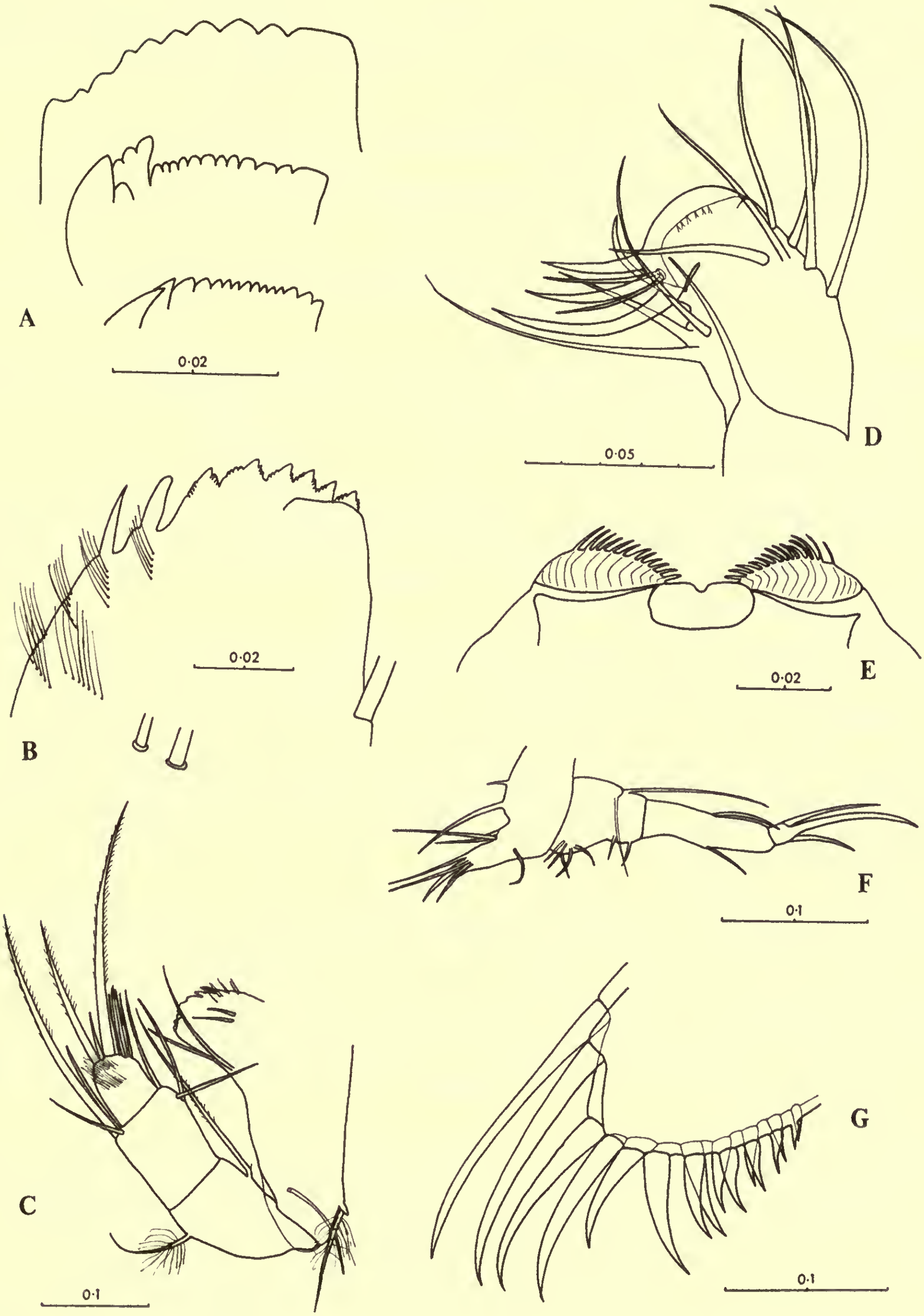
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FIG. 8. *Conchoecia macroprocera* sp. nov. A, mandible tooth lists and toothed edge of the coxale; B, mandible toothed edge of the basale; C, mandible endopodite; D, maxilla endopodite; E, labrum; F, fifth limb; G, caudal furca.

Maxilla (fig. 8D). There is a basal seta. On the endopodite the first segment carries six anterior, one lateral and three posterior setae. There are about six spinules on the distal edge of the segment near its articulation with the second segment.

Labrum (fig. 8E). The hyaline membrane has a shallow rounded notch.

Caudal furca (fig. 8G). The first hook spines reach just short of the tips of the second pair. There is no unpaired seta dorsal of the hook spines. Between the two caudal lamellae is a covering of fine hairs.

Penis (fig. 7K). The end of the organ is rounded and it contains four oblique muscles.

FEMALE. The paratype mounted on slides in Euparal and stained with lignin pink has been deposited in the British Museum (Natural History) No. 1971.2.1.4. Collection data as for *C. microprocera* sp. nov.

Carapace (figs 9A, B). The range in length of 263 specimens was 1·26–1·36 mm with a mean of 1·304 ± 0·021 mm. The relative height of the carapace is noticeably less than for *C. procera* Müller although its breadth is similar. The asymmetrical glands are positioned as in the other two species. There is no spine on the right valve at the posterior dorsal corner.

Frontal organ (fig. 9C). The total length of the organ is nearly three times the length of the limb of the first antenna. There is some demarcation into shaft and capitulum. Near the rounded tip there is a row of spines on the ventral surface.

First antenna (fig. 9C). The segmentation is indistinct and there is no additional armature. The **a–d** setae are more than half the length of the **e** seta. The **e** seta carries short spinules on its posterior edge and sparser long spinules on the distal half of its anterior edge.

Second antenna (fig. 9D). The ratio of the relative lengths of the segments of the limb are very similar to those for *C. procera* Müller (Table 1), although the longest swimming seta does tend to be longer. On the endopodite the **a** seta is bare and 2/3's the length of the **b** seta. The **b** seta carries a few short spinules. On the segment near the bases of these setae are about eight short fine spinules. The second segment is almost bare with only about three or four hairs. All the main setae are bare and thin walled. The **g** seta is only a little longer than the others but is much broader.

Synonomies. Müller (1906a) gave a size range for *C. procera* which suggests that his material included this species. Similarly Leveau's (1965) report of *C. procera* Müller reaching a length of 1·30 mm may indicate its presence in the Mediterranean. Leveau reported two centres of abundance in *C. procera* Müller at 200–100 m and 500–300 m. It seems possible that the deeper population may be this species. The species was absent from Deevey's (1968) material, but has turned up in very small numbers recently in samples taken near 17°45′N, 25°30′W (Angel unpublished). Thus this species may not normally occur north of about 18°N in the North Atlantic.

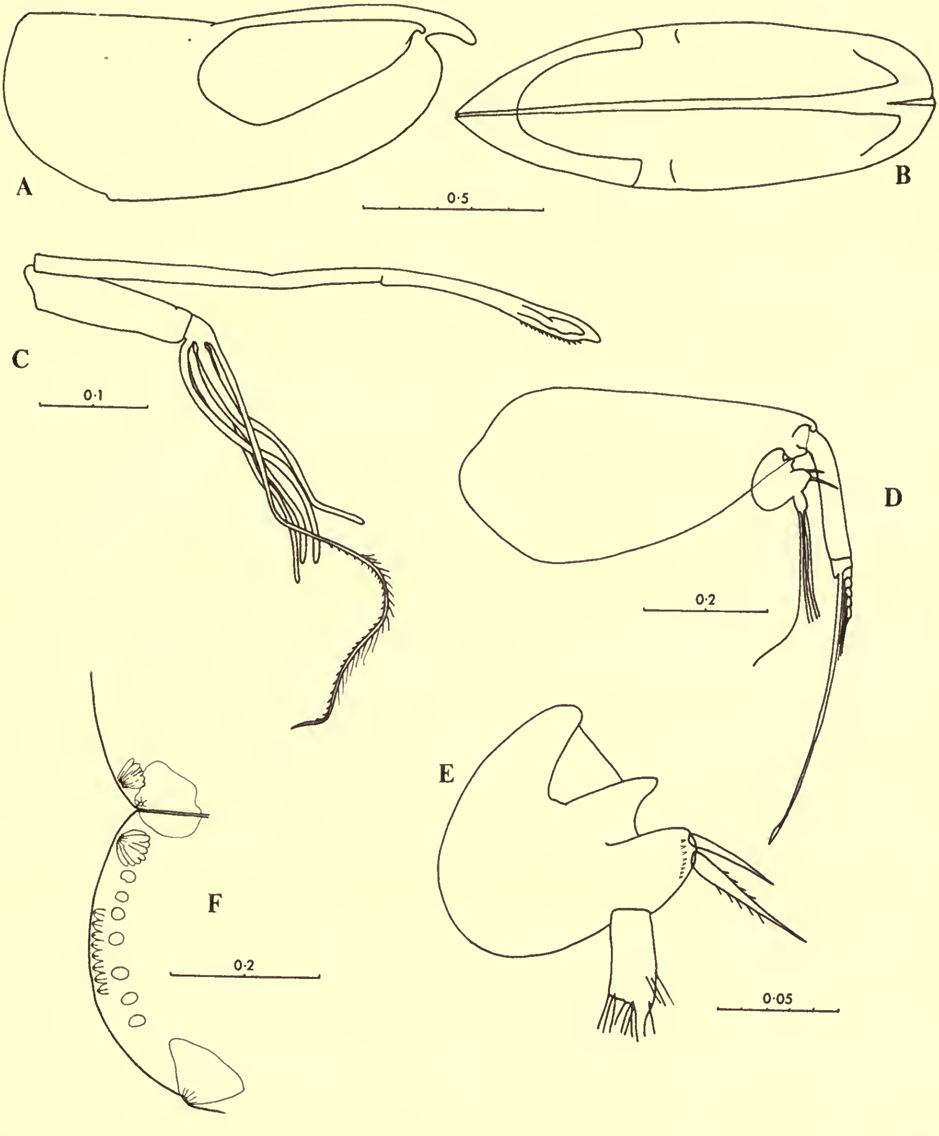

FIG. 9. *Conchoecia macroprocera* sp. nov., female. A, lateral view of carapace; B, ventral view of carapace; C, frontal organ and first antenna; D, second antenna; E, second antenna endopodite; F, details of the posterior dorsal corner of the male carapace.

Conchoecia vitjazi Rudjakov 1962

MATERIAL. A single female was found in a 'Discovery' net (Currie & Foxton 1957) haul from 'Discovery' station 4768, position 40°03'N, 19°57'W, depth 4750–4000 m, time 1402–1640 hrs, date 12 October 1961. Since no description is available in English, the specimen is described in full.

MALE. The male is unknown.

FEMALE. *Carapace.* The length of the 'Discovery' specimen is 2·00 mm. Rudjakov's specimens ranged from 2·20–2·30 mm. The 'Discovery' specimen was too distorted to make accurate measurements of carapace height and breadth, but the height is about half the carapace length. The whole carapace is covered with a fine V-shaped sculpturing (fig. 10A). The right asymmetrical gland opens on a small prominence (possibly an artefact) and the left asymmetrical gland about 0·1 mm from the posterior dorsal corner (fig. 10A). The right valve carries a minute spine at the posterior dorsal corner. The outline of the carapace is very similar to Rudjakov's (1962) figure 2a.

Frontal organ (fig. 10B). The organ is much longer than the limb of the first antenna. There is no clear distinction into stalk and capitulum. Terminally the organ is down-turned and carries a few small spinules on the ventral corner (fig. 10C).

First antenna (fig. 10B). The segmentation is indistinct and there is no additional armature. The dorsal seta is absent. The **e** seta is over twice the length of the other setae and only carries a few fine spinules on the distal third of its trailing edge. These spinules were on the third quarter of the **e** seta in Rudjakov's specimens.

Second antenna (fig. 10E). The proportion of the protopodite : exopodite segment 1; exopodite segments 2–8 is 6 : 3 : 1 in the 'Discovery' specimen and 4 : 2·8 : 1 in Rudjakov's specimens. On the endopodite (fig. 10F) the processus mamillaris is small and bluntly pointed. The **a** seta is bare and two thirds the length of the **b** seta. The **b** seta carries a group of long hairs near its base and very fine spinules for about half its length. The **c, d** and **e** setae are all absent. The **g** seta is as long as the protopodite, and is flattened terminally with fine spinules along the edge of the flattened part. The other setae are long subequal, thin-walled and without shafts.

Mandible (fig. 11B). The toothed edge of the basale is typical for the genus (fig. 11A). The broad outer tooth is as broad as three of the other teeth. The outer setae project just beyond the level of the teeth. There are four groups of hairs near the bases of the tubiform teeth. Between the toothed edge and the articulation with the first endopodite segment is a patch of fine hairs. The inner edge of the first endopodite segment carries one long seta reaching well beyond the tips of the shorter of the terminal setae, and three minute setae arranged in a line up the segment. On the distal half of the outer surface of the outer segment is a patch of fine spinules. The toothed edge of the coxale has nine unusually elongate teeth (fig. 10D). The distal list has two large teeth, the second of which is very serrated, followed by 17 small teeth. The proximal list has a large tooth followed by about six small teeth, another large tooth and a further 20 smaller irregular teeth. This is in substantial agreement with Rudjakov's (1962) type description. There is a seta on the distal outer edge of the first segment which Rudjakov noted as absent but was probably broken off in his specimens.

Maxilla (fig. 11C). The maxilla has a long basal segment. There are six anterior, one lateral and three posterior setae on the first segment. There are no spines on the outer edge of the segment. The second endopodite segment is long and thin with long terminal hook setae.

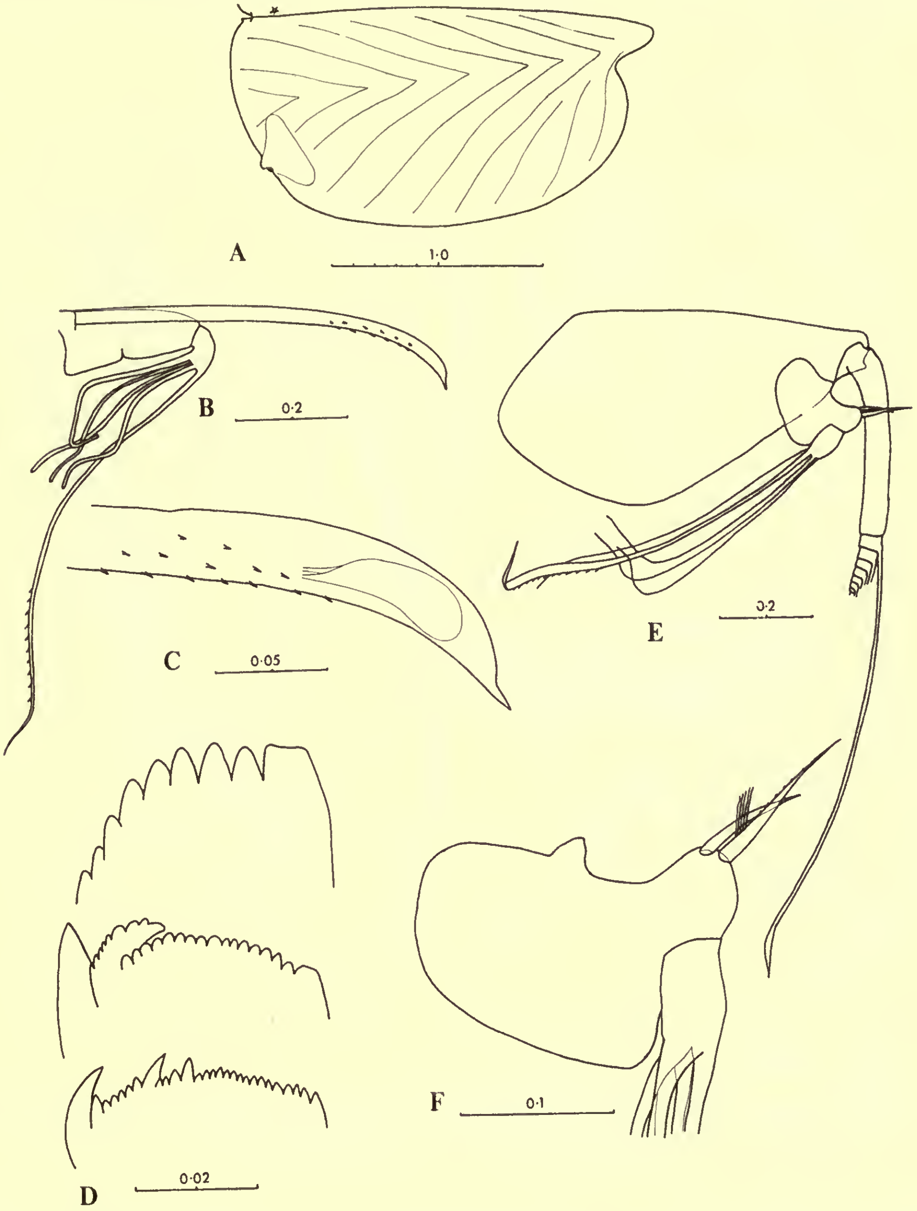

FIG. 10. *Conchoecia vitjazi* Rudjakov, female. A, carapace right valve mounted flat; B, frontal organ and first antenna; C, detail of the tip of the frontal organ; D, mandible tooth lists and toothed edge of the coxale; E, second antenna; F, second antenna endopodite.

Labrum. The hyaline membrane has a deep rounded notch.

Caudal furca. The first pair of hook spines just fail to reach level with the ends of the second pair. There is an unpaired seta dorsal of the hook spines. Between the lamellae is a covering of fine hairs.

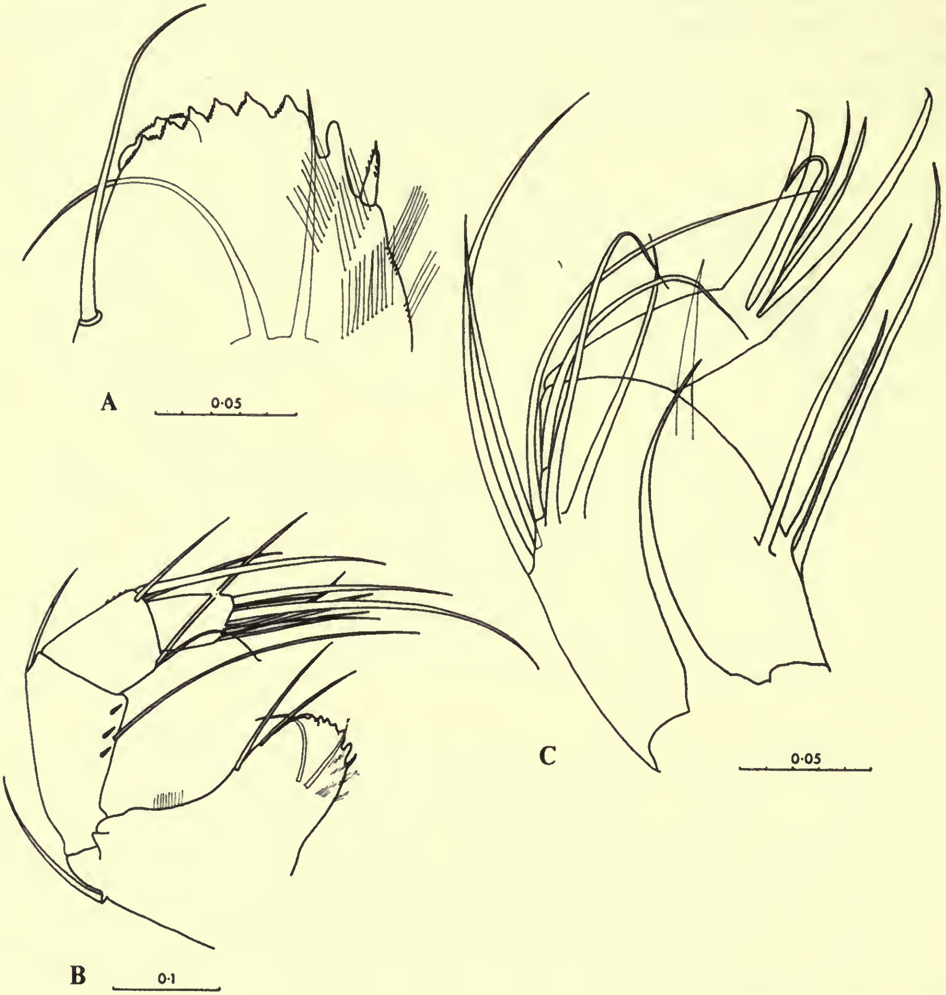

FIG. 11. *Conchoecia vitjazi* Rudjakov, female. A, mandible toothed edge of the basale; B, mandible endopodite; C, maxilla endopodite.

DISCUSSION

At 'Discovery' station 6665 *C. procera* Müller was most abundant by day from 50–300 m, *C. microprocera* sp. nov. was most abundant at 25 m and occurred in quite large numbers down to 100 m, *C. macroprocera* sp. nov. was most abundant

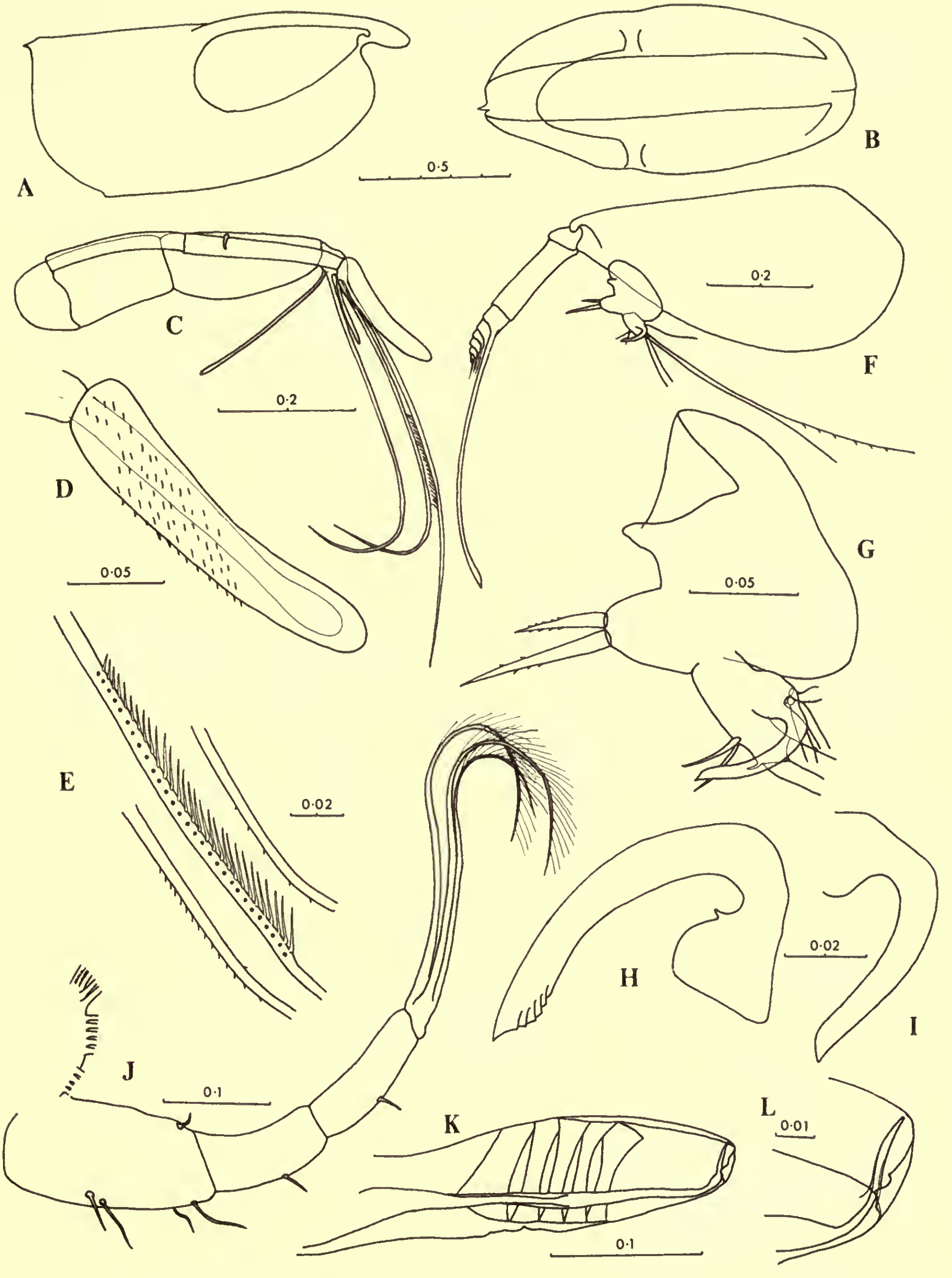
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FIG. 12. *Conchoecia decipiens* Müller, male. A, lateral view of the carapace; B, ventral view of the carapace; C, frontal organ and first antenna; D, frontal organ capitulum; E, first antenna armature of the b, e and d setae; F, second antenna; G, left second antenna endopodite; H, right hook appendage; I, left hook appendage; J, sixth limb; K, penis; L, details of the tip of the penis.

from 500–300 m and was absent from above 200 m. At night *C. procera* and *C. microprocera* showed reverse migrations out of the surface 50–75m, whereas *C. macroprocera* did not migrate.

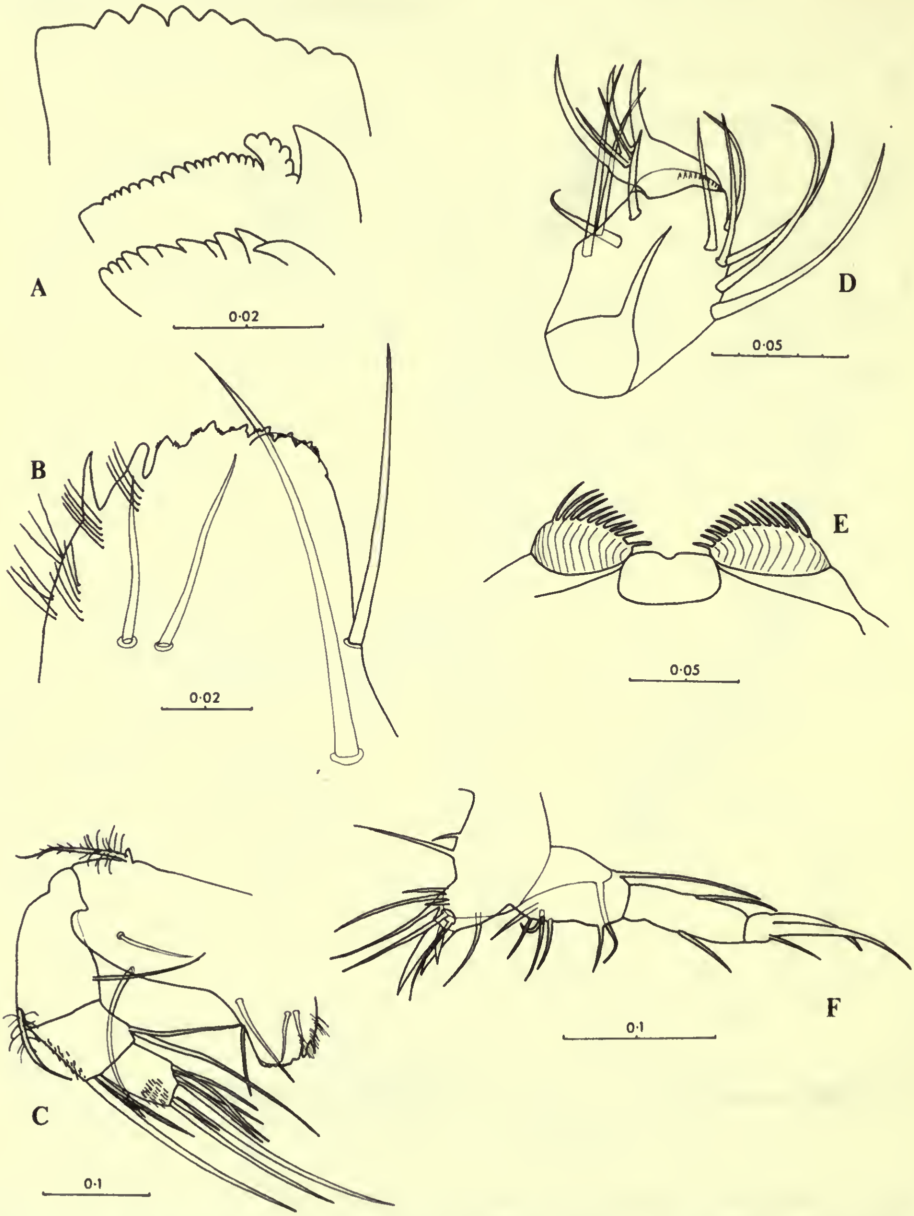

FIG. 13. *Conchoecia decipiens* Müller. A, mandible tooth list and toothed edge of the coxale; B, mandible toothed edge of the basale; C, mandible endopodite; D, maxilla endopodite; E, labrum; F, fifth limb.

The other species which have been attributed to the *'procera'* group are *C. decipiens* Müller 1906a, *C. brachyaskos* Müller 1906a and *C. vitjazi* Rudjakov 1962. *C. decipiens* has only been reported from the Indian Ocean from between 23°N (Leveau 1968) and 25°S (Müller 1908). To show clearly the differences between *C. decipiens* Müller and the other species, especially *C. macroprocera* sp. nov. drawings of specimens lent me by Mr J. George of the Cochin Indian Ocean Sorting Centre are included (figs 12, 13, 14). Table 1 also includes measurements of the specimens.

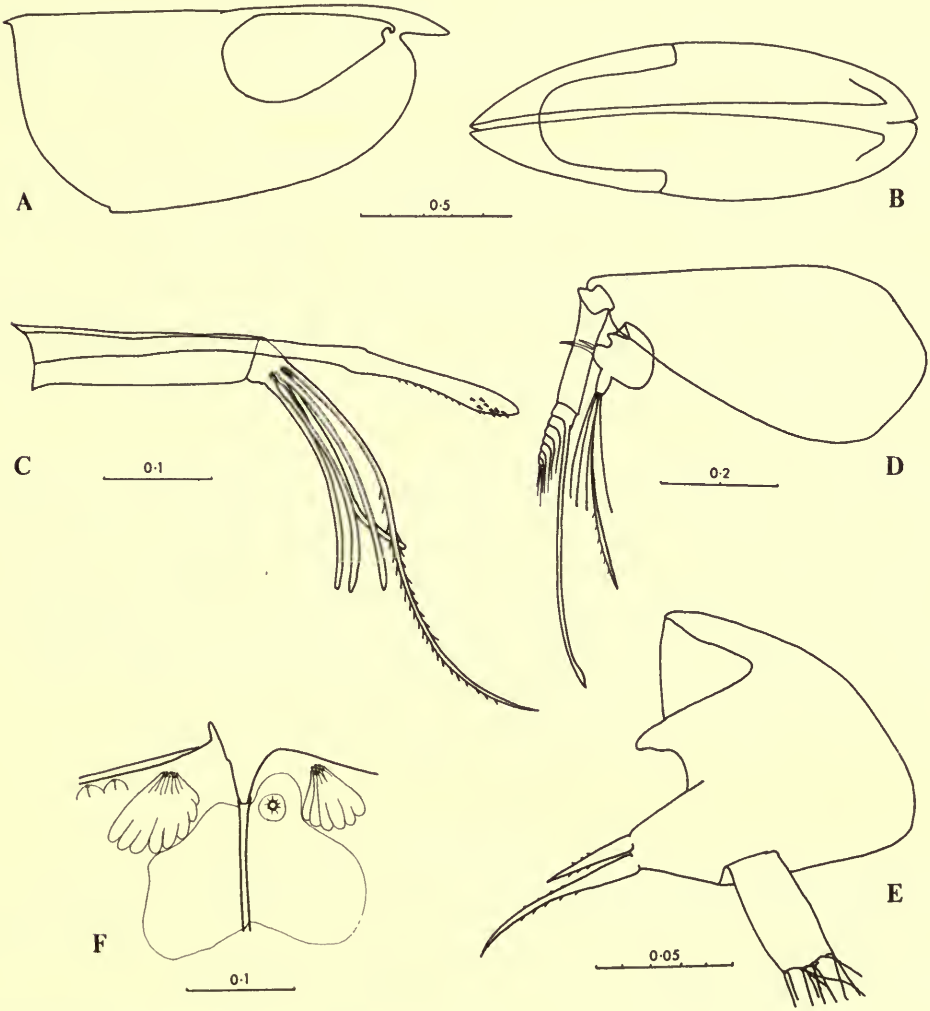

FIG. 14. *Conchoecia decipiens* Müller, female. A, lateral view of the carapace; B, ventral view of the carapace; C, frontal organ and first antenna; D, second antenna; E, second antenna endopodite; F, male, detail of the posterior dorsal corner of the carapace.

C. decipiens Müller has a large spine and secondary spine on the right carapace valve at the posterior dorsal corner. In the males the following characters distinguish *C. decipiens* from *C. macroprocera*: (1) The capitulum of the frontal organ is distinctive. (2) The first antenna is relatively longer in *C. decipiens.* (3) The first antenna **e** seta armature has no distally pointing spinules and the main spines decrease in size proximally. (4) On the second antenna the protopodite is longer and the shape of the right hook appendage is distinctive. (5) The endopodite of the mandible carries two setae on the inner face of the first segment. (6) The penis has five oblique muscles.

In the females the following characters distinguish *C. decipiens* from *C. macroprocera*: (1) The outline of the carapace, (2) the shape of the frontal organ, (3) the endopodite of the second antenna has no spinules on the first segment near the bases of the **a** and **b** setae, the second segment is completely bare and the **g** seta is markedly flattened.

Müller (1906a) included *C. brachyaskos* in the '*procera*' group on the basis of the female frontal organ and the shortness of the sensory setae on the endopodite of the male second antenna. However, because of the setation of the male first antenna and its distinctive **e** seta armature (Müller 1906a T. XIV fig. 12), it has not been included here. *C. brachyaskos* Müller was present in the deep midwater samples from 'Discovery' station 6665. There are two size groups; the larger occurring only from below 1000 m. This large form is superficially very similar to the Antarctic form and so this species requires careful taxonomic investigation before its status can be certain.

The discovery of a specimen attributable to *C. vitjazi* Rudjakov in the North Atlantic provides an interesting example of the faunistic relationships between the Pacific and the North Atlantic (c.f. Briggs 1970). This species, only recorded before from below 6000 m in the Kurile-Kamchatka Trench (46°31'N, 154°22'E, 43°48'N, 149°55'E), was considered by Rudjakov (1962) to be endemic to that region. The 'Discovery' specimen does show some minor variations from the type description, but these are not considered great enough to attribute to it new specific rank. The male of the species is yet to be described and so the inclusion of the species in the '*procera*' group is yet to be confirmed.

SUMMARY

1. *Conchoecia procera* Müller is shown to have been confused with two very closely related but distinct species in the past.

2. *C. procera sensu strictu* is described and the two new species are described and named *C. microprocera* sp. nov. and *C. macrorpocera* sp. nov.

3. An adult female ascribed to *C. vitjazi* Rudjakov 1962 is described from the North Atlantic; a species previously thought to be endemic to the Kurile-Kamchatka Trench.

4. The inclusion of *C. brachyaskos* Müller in the '*procera*' group is questioned.

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ZOOLOGY Vol. 21 No. 8
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CONCHOECIA PSEUDOPARTHENODA (NOV. SP) A NEW HALOCYPRID OSTRACOD FOR THE TROPICAL NORTH ATLANTIC

By M. V. ANGEL

INTRODUCTION

In the Spring of 1968 a series of horizontal tows were made by R.R.S. Discovery at station 6665 to study the vertical distribution of planktonic animals at 10° 16′ N, 19° 47′ W. A new *Conchoecia* species belonging to the *magna* group and very closely related to *C. parthenoda* Müller 1906 occurred in the near surface hauls. The species is described here and named *Conchoecia pseudoparthenoda*.

Conchoecia pseudoparthenoda n. sp.

The type specimens were from haul 36 at station 6665 from a depth of 25 m at 1637–1715 hrs on 26 February 1968, position 10° 16′ N, 19° 47′ W. They are deposited mounted on slides in the British Museum (Natural History), male No. 1971.2.1.5, female No. 1971.2.1.6.

Male. The range in carapace length of 120 specimens was 1·56–1·72 mm with a mean of 1·637 ± 0·037 mm. The outline of the carapace (Fig. 1A) is similar to that of *C. parthenoda* Müller (Deevey 1968, Angel 1969a). The position of the left asymmetrical gland is quite distinctive; in the type specimen it opens 0·48 mm anterior of the posterior carapace hinge. The right asymmetrical gland opens at the usual position on the posterior ventral corner. Fine spines occur along the dorsal surface of the carapace in the region of the hinge line, and on the edges of the valves from below the rostral incisure to about the midpoint of the ventral side.

Frontal organ. The shaft extends to level with the end of the limb of the first antenna (Fig. 1B). The capitulum is down-turned, its posterior edge is almost straight and carries spines down the proximal two thirds (Fig. 1C). The anterior edge is slightly concave so that the capitulum is narrowest in its middle region, and carries a few spines near its base. The end of the capitulum is rounded.

First Antenna. The two basal segments are sub-equal and bare (Fig. 1B). The **a** seta lies back parallel with the limb reaching level with or just short of the joint between the two basal segments. The **c** seta is short. The **b** seta carries nine fine spines level with the distal end of the armature on the **e** seta (Fig. 1D), whereas the **d** seta carries about 27 fine spines. The **b** seta is only slightly shorter than the **d** seta, which is only just shorter than the **e** seta. The **e** seta armature consists of 9 to 10 paired spines followed by 22–26 alternating spines, with a total range of 40–44 spines (Fig. 1D). The **e** seta also has a few scattered spines on its anterior leading edge close to its base.

Second Antenna. The protopodite is more than half the length of the carapace and three times the first exopodite segment (Fig. 1E). All the exopodite segments are bare. The longest swimming seta is two fifths the carapace length. On the endopodite, the **a** seta is bare and curves back behind the **b** seta (Fig. 1G). The **b**

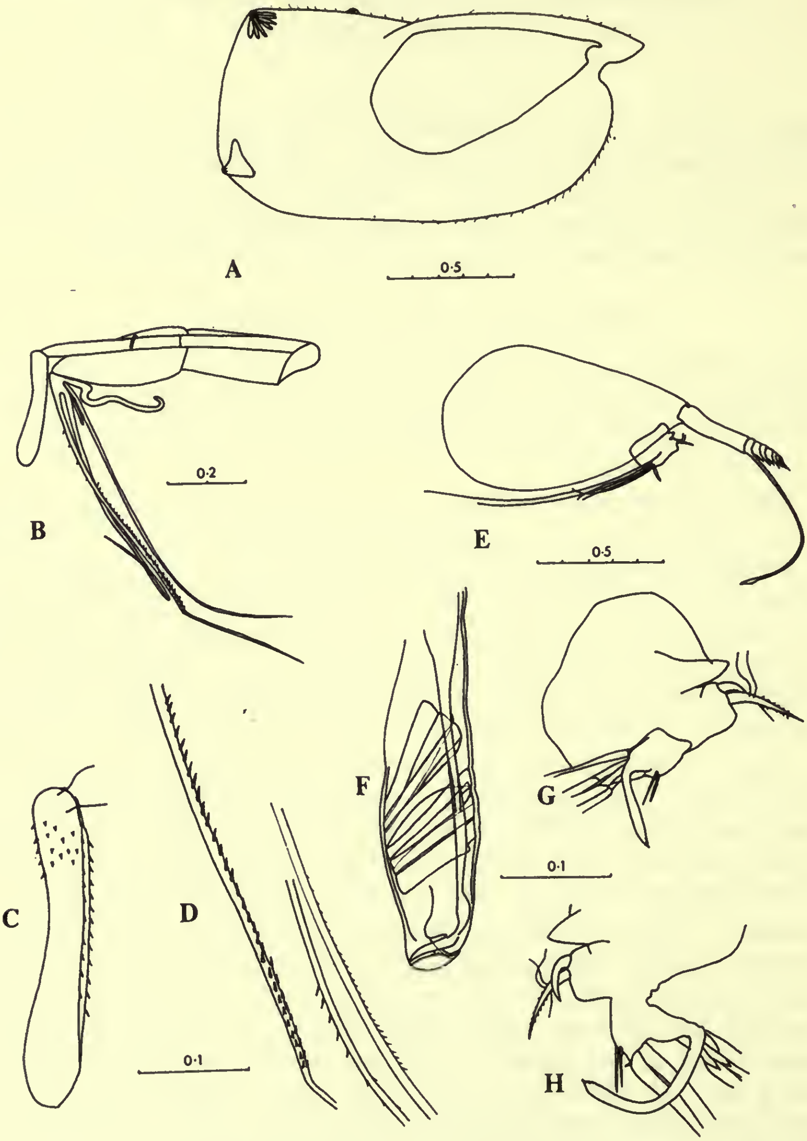

FIG. 1. *Conchoecia pseudoparthenoda* male. A. Outline of carapace. B. Frontal organ and first antenna. C. Capitulum of frontal organ. D. Detail of armature of the antennular **e, b** and **d** setae. E. Second antenna. F. Copulatory organ. G. Endopodite of the left second antenna. H. Endopodite of the right second antenna.

seta carries three long hairs near its base and fine spines distally. The processus mamillaris is bluntly pointed. The **c** and **d** setae are sub-equal and rather short. The **e** seta is minute. The **g** seta is almost as long as the protopodite and the **f** seta is similar in length to the longest swimming seta. The **h**, **i**, and **j** setae are half the length of the **f** seta and about two-fifths the length of the **g** seta. They have weakly developed shafts. The right hook appendage is right angled near its base, curves through a further 90° half way along its length ending in a point with subterminal ridging (Fig. 1H). The left hook appendage is bent through less than a right angle near its base and is then straight (Fig. 1G). Towards its end it narrows and terminates in a curved point with subterminal ridging.

Mandible. The basal segment is long (Fig. 2C). The first exopodite segment carries two setae on its inner edge, one twice the length of the other. The toothed edge of the pars incisa has two spine teeth followed by six broad finely serrated teeth, and a single inner broad tooth (Fig. 2B). Hairs are inserted near the bases of the spine teeth and the outer setae. These setae project only just beyond the level of the teeth. The coxale toothed edge has ten bluntly pointed teeth (Fig. 2A). The distal tooth list has two large teeth; the second is serrated and followed by 13 small blunt teeth. The proximal list has about 14 irregularly sized teeth.

Maxilla. The basal segment carries a seta (Fig. 2D). The first endopodite segment has six anterior, one lateral and three posterior setae. There is a group of about six short spines at the end of the segment.

Labrum. This is the usual shape for the *magna* group (Fig. 2E).

Caudal Furca. The furca has eight pairs of hook spines (Fig. 2F). The first pair does not reach the level of the ends of the second pair. There is no unpaired posterior seta.

Copulatory organ. This has eight oblique muscles (Fig. 1F). The terminal edge which curves in and over the intromittent spine is serrated.

FEMALE. The range in length of 222 specimens was 1·72–1·90 mm with a mean of 1·841 ± 0·038 mm. As in the male the left asymmetrical gland opens 0·48 mm anterior of the posterior hinge, and the right gland on the posterior ventral corner (Fig. 3A). Fine spines occur on the dorsal surface in the vicinity of the hinge line and round the ventral edges of the valves in the anterior half. In many specimens there were concentric striations clearly visible over the whole of the carapace.

Frontal organ. It is straight with no separation into shaft and capitulum (Fig. 3B). It terminates in a long downturned point. There are a few spines on its ventral edge (Fig. 3C).

First Antenna. The segmentation of the limb is indistinct. The long spinous dorsal seta reaches almost level with the tip of the frontal organ (Fig. 3B, C). There is a group of spinules close to the insertion of the **e** seta. The **e** seta is twice the length of the limb and carries spines on its trailing posterior edge distal of the ends of the other setae. The other four setae are a third the length of the **e** seta.

Second Antenna. The protopodite is just less than half the carapace length and nearly three times the length of the first exopodite segment (Fig. 3D). All the exopodite segments are bare. The longest swimming seta is three quarters the length of the protopodite. On the endopodite the **a** seta is half the length of the

b seta, and both are finely spinous (Fig. 3E). The processus mamillaris has a small pointed tubercle at its tip. The **g** seta is just over half the length of the protopodite. It is unflattened and carries fine spinules near its tip. The **f** seta is only a little longer than the **h**, **i** and **j** setae which are two thirds the length of the **g** seta.

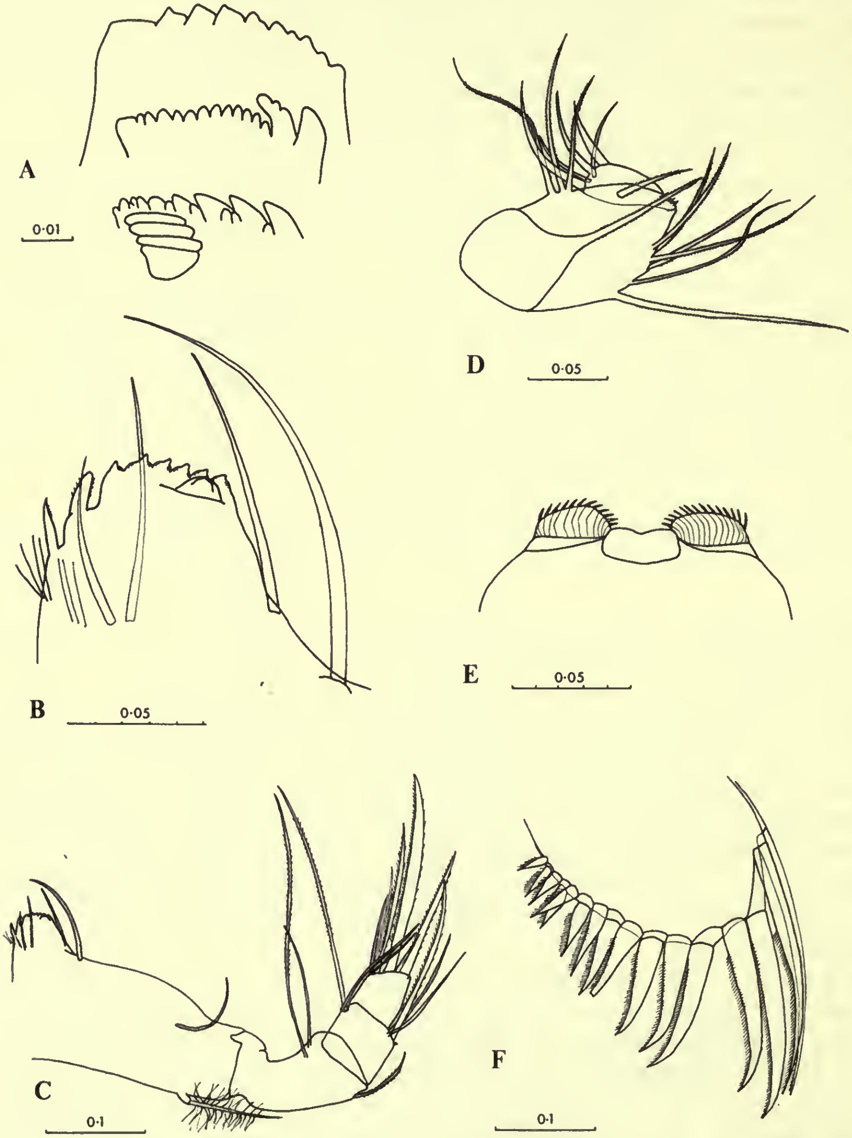

FIG. 2. *Conchoecia pseudoparthenoda.* A. Toothed edge of coxale and tooth lists of the mandible. B. Toothed edge of the mandibular basale. C. Endopodite of the mandible. D. Maxilla endopodite. E. Labrum. F. Caudal furca.

Juveniles. Two juvenile stages were recognised from the hauls by the position of the left asymmetrical glands. The smallest group consisting of 106 specimens ranged in size from 0·86–0·96 mm with a mean of 0·903 ± 0·022 mm. The final stage juveniles ranged in size from 1·22–1·34 mm with a mean of 1·286 ± 0·026 mm for 163 specimens.

Comparison between *C. pseudoparthenoda* and *C. parthenoda*. In the females, *C. pseudoparthenoda* often has more distinctive sculpturing and the posterior ventral region of the carapace is more strongly developed. In both sexes the left asym-

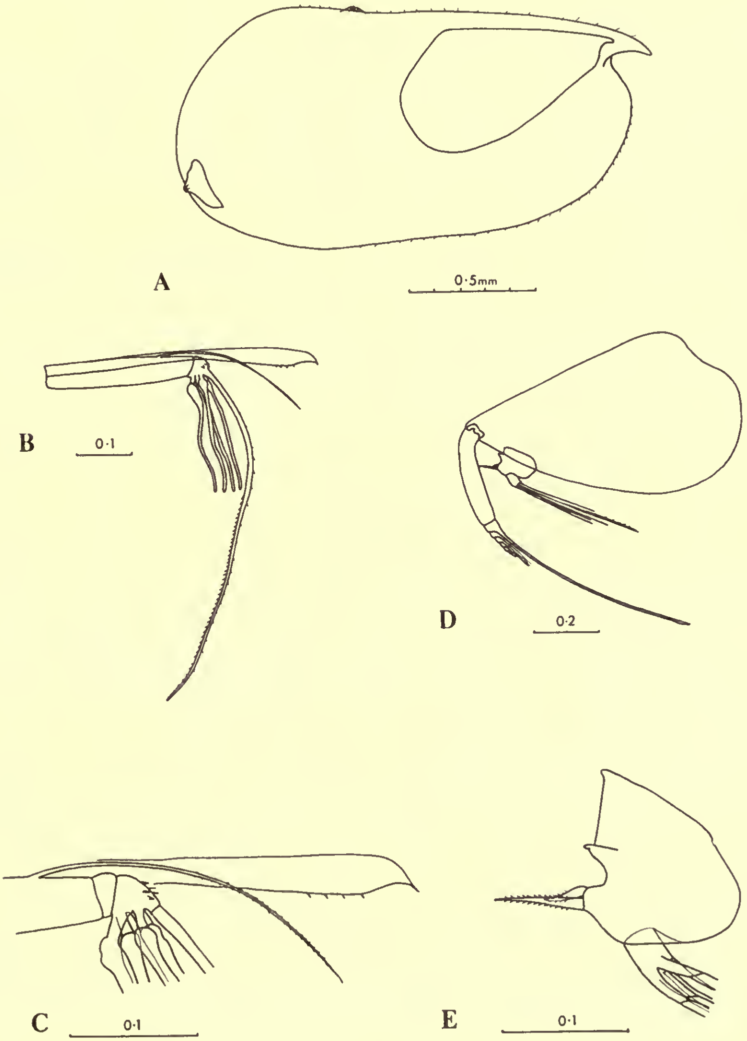

Fig. 3. *Conchoecia pseudoparthenoda* female. a. Outline of carapace. b. Frontal organ and first antenna. c. Details of frontal organ and the end of the first antenna. d. Second antenna. e. Endopodite of the second antenna.

metrical gland is 0·48 mm anterior of the posterior hinge, and this is diagnostic of the species; in *C. parthenoda* the gland opens 0·24 mm anterior of the posterior hinge. The carapace breadth is less in *C. pseudoparthenoda*. The shapes of the frontal organs of the females of the two species are quite distinct. The dorsal seta of the first antenna is shorter in the female of *C. parthenoda* and this species has no spinules at the insertion of the first antennal **e** seta, also the **e** seta is relatively longer. Similarly the exopodite segments and the endopodite setae of the second antennae of the females are all relatively longer in *C. parthenoda*. A comparison of the lengths of the various setae and other meristic characters of the two species are shown in Table 1.

In the males *C. parthenoda* has a longer **b** seta on the first antenna and a shorter **c** seta; the **b** and **d** setae carry more spines. The antennular **e** seta armature usually consists in both species of nine pairs of distal spines. In *C. parthenoda* the paired spines are followed by about 18 alternating spines; giving a total range of 35–38 spines. In *C. pseudoparthenoda* the paired spines are followed by about 24 alternating spines; giving a total range of 40–44 spines.

On the mandibles the proximal tooth lists are quite distinct; *C. parthenoda* having three large teeth and 16 smaller teeth, and *C. pseudoparthenoda* 14 irregular teeth. On the caudal furca *C. parthenoda* has an unpaired dorsal seta but *C. pseudoparthenoda* has none. The live colouration of the two species is similar, for the most part they are transparent and colourless or very pale red. The anterior ventral edges of the carapace valves are yellow, and the pharyngeal region is yellow or orange.

Bioluminescence has not been observed in either of the two species.

DISCUSSION

At station 6665 *C. pseudoparthenoda* predominated over *C. parthenoda* at 25 m, but *C. parthenoda* was the more numerous in the 50 m and 75 m hauls. Both species were virtually restricted to the surface 100 m. *C. pseudoparthenoda* was absent from the plankton off Fuerteventura (Canary Islands) and the Moroccan coast (Angel 1968, 1969b), but Deevey (personal communication) has found what is probably this species to be a rare member of the plankton off Bermuda. *C. parthenoda* was common in all these areas.

Poulsen (1969) has recently described a male specimen from the Congo region with the gland openings of the left asymmetrical gland 0·38 mm from the posterior dorsal hinge (see his figure 10 and table p. 154). The females, however, had gland openings 0·27 mm from the hinge. The carapace lengths of all his specimens were slightly larger than described here for *C. pseudoparthenoda*, and appreciably longer than for *C. parthenoda*. His description of the male antennular **e** seta armature makes no mention of the distal spines being paired, and the total counts are considerably lower than for either *C. parthenoda* or *C. pseudoparthenoda*. It seems unlikely from his description that Poulsen's specimens belonged to either of these species.

C. pseudoparthenoda appears to have an equatorial distribution in the Atlantic and may prove to be endemic to this region.

Table I

Comparative table of meristic characters of *C. pseudoparthenoda* (n. sp.) and *C. parthenoda* Müller; data for *C. parthoneda* Müller from Angel 1969a. All values, apart from the range and mean of carapace lengths, are the means of twenty specimens and are expressed as percentages of the carapace lengths.

	C. parthenoda Müller		*C. pseudoparthenoda* (n. sp.)	
	♀	♂	♀	♂
Carapace				
Length range mm	1·575 — 1·750	1·450 — 1·600	1·720 — 1·900	1·560 — 1·720
mean	1·671 ± 0·033	1·520 ± 0·028	1·841 ± 0·038	1·637 ± 0·037
Length %	100	100	100	100
Height	50·03 ± 1·29	48·01 ± 1·08	49·24 ± 0·84	48·20 ± 2·18
Breadth	39·52 ± 1·33	45·00 ± 1·09	36·54 ± 1·14	41·85 ± 1·53
Frontal Organ				
shaft	29·85 ± 1·02	40·84 ± 1·07	29·60 ± 0·79	41·39 ± 0·90
capitulum		17·11 ± 0·76		17·08 ± 0·59
First Antenna				
Segment 1		19·12 ± 0·45		19·84 ± 0·38
,, 2		18·62 ± 0·36		19·51 ± 0·51
Total limb	16·83 ± 0·45	39·72 ± 0·55	17·06 ± 0·24	39·80 ± 0·82
a seta	12·98 ± 0·43	18·44 ± 1·25	12·86 ± 0·57	17·96 ± 1·04
b seta		53·46 ± 1·18		51·26 ± 0·97
c seta		6·14 ± 0·23		7·10 ± 0·33
d seta		54·08 ± 1·21		52·69 ± 1·03
e seta	37·31 ± 1·12	57·46 ± 1·00	35·86 ± 1·00	56·09 ± 0·96
dorsal seta	14·80 ± 0·71	—	15·19 ± 0·64	—
Second Antenna				
Protopodite	46·98 ± 0·80	53·69 ± 1·19	46·24 ± 0·64	54·56 ± 0·84
Exopodite segt. 1	16·91 ± 0·31	18·28 ± 0·38	16·00 ± 0·45	18·52 ± 0·40
,, ,, 2–8	7·01 ± 0·12	7·93 ± 0·24	6·80 ± 0·17	7·59 ± 0·16
g seta	26·48 ± 0·79	53·61 ± 0·99	24·52 ± 0·98	52·83 ± 0·94
f seta	18·55 ± 0·66	40·85 ± 0·81	17·22 ± 0·51	40·26 ± 1·10
h, i, j seta	17·44 ± 0·56	21·04 ± 0·64	15·78 ± 0·45	19·68 ± 0·83
longest swimming seta	36·95 ± 0·82	40·89 ± 1·22	35·57 ± 0·88	40·73 ± 0·81

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THE TYPE SPECIMENS AND IDENTITY OF THE SPECIES DESCRIBED IN THE GENUS *LITHOBIUS* BY GEORGE NEWPORT IN 1844, 1845 AND 1849 (CHILOPODA, LITHOBIOMORPHA)

By E. H. EASON

INTRODUCTION

GEORGE NEWPORT described eighteen nominal species under *Lithobius* one of which, *L. emarginatus*, he later removed to the genus *Henicops*. Pocock (1890, 1891a, 1891b, 1901) examined the type specimens of at least eight of these species but he only identified five, one of them incorrectly. Of the remainder, some have been identified more or less definitely by various authors from their original descriptions but the identity of the others has only been tentatively suggested or has, hitherto, been quite unknown. The type specimens of sixteen of Newport's species are preserved either in the British Museum (Natural History), the Hope Department of Zoology, Oxford or the Muséum National d'Histoire Naturelle, Paris. They have all been re-examined for the purpose of the present study and their identity is either confirmed or established for the first time. It is not always possible to tell whether Newport had one or several specimens before him when he wrote his descriptions and he made no formal designation of type specimens, but where only a single specimen is available it is regarded as the holotype: otherwise a lectotype is selected where necessary. An attempt is also made to determine the identity of the species for which type specimens have not been found.

Newport's 1844–45 paper was divided between parts 3 and 4 of volume 19 of the *Transactions of the Linnean Society of London*. The section in part 3, which includes a figure with the caption 'Lateral view of the head of *Lithobius americanus*, Newp.' (Tab. 33), was published in November 1844, but the section in part 4, which includes the written descriptions of this and eight other new species of *Lithobius*, was not published until November 1845 (Raphael, 1970). The species described in this paper are usually dated 1844, but clearly all except *L. americanus* should be dated 1845.

Conclusions as to the status and present classification of all the nominal species described by Newport in the genus *Lithobius* are summarized in Table 1.

1. ***Lithobius hardwickei*** Newport

Fig. 1

Lithobius Hardwickei Newport, 1844, p. 96; 1845 (1844–45), p. 366

TYPE LOCALITY. Singapore.

TYPE SPECIMEN. *Holotype*: a male pseudomaturus of *L. forficatus* (Linn.) 16·5 mm long, dried and pinned, labelled "L. Hardwickei Newp." in Newport's hand and

"Hardwicke Bequest, Singapore" on a separate ticket. British Museum (Natural History).

REMARKS. As Newport stated, this specimen is smaller than an adult of *L. forficatus* and of a paler colour than usual: it has only 39 antennal articles (Newport gave 41) but the prosternum is exactly as described by Newport with 5+8 teeth (Fig. 1).

According to Haase (1887), Pocock examined the specimen and found it to have posterior projections on T. 9, 11 and 13 but came to no conclusion as to its identity. Verhoeff (1937) merely noted that Newport's description of *L. hardwickei* agreed with none of the species of *Lithobius* he found in the Malay peninsula. Wang and Tang (1965), in the most recently published list of Chilopoda from Singapore, made no mention of the species and there is little doubt that *L. forficatus* was introduced to Singapore but never became established.

2. ***Lithobius leachi*** Newport

Lithobius forficatus: Leach, 1814, p. 408
Lithobius Leachii Newport, 1844, p. 96; 1844 (1844–45), Tab. 33, fig. 30
Lithobius sp. Newport, 1844 (1844–45), Tab. 33, fig. 31
Lithobius Leachii: Newport, 1845 (1844–45), p. 368

TYPE LOCALITY. Europe.

TYPE SPECIMEN. *Holotype*: a female of *L. forficatus* (Linn.) 20 mm long, dried and gummed to a card over the whole of its ventral aspect, labelled "L. Leachii Newp." in Newport's hand. British Museum (Natural History).

REMARKS. Newport examined the original Linnean specimen of *L. forficatus* and finding it to differ slightly in the form of the prosternum from Leach's specimen of this species, referred the latter to a new species, *L. leachi*. Synonymy of *L. leachi* with *L. forficatus* was tentatively suggested by Meinert (1868) and has never been disputed. Although the ventral aspect of the holotype is obscured owing to its being gummed to a card, it is undoubtedly the specimen which Newport examined and which Leach had, quite correctly, identified as *L. forficatus*.

3. ***Lithobius pilicornis*** Newport

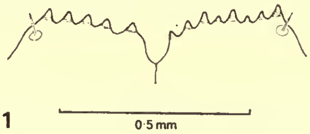
Lithobius pilicornis Newport, 1844, p. 96
Lithobius sp. Newport, 1844 (1844–45), Tab. 33, fig. 34
Lithobius pilicornis: Newport, 1845 (1844–45), p. 369

TYPE LOCALITY. England.

TYPE SPECIMEN. *Holotype*: a male 26 mm long, dried and pinned, labelled "L. pilicornis Newp." in Newport's hand. British Museum (Natural History).

REMARKS. This specimen was described by Pocock (1891a) who gave a full account of the species.

Gervais, in his list of published descriptions of species of Myriapoda (Walckenaer and Gervais, 1847), mentioned *Lithobius pulchricornis* and *L. pilicornis* as having been described by Newport in 1844 and 1845 respectively. It seems that *pulchricornis* attaches to Newport's first (1844) brief description of *L. pilicornis*. The name does not appear in any of Newport's works and must have arisen from some carelessly written transcript of his earlier paper.



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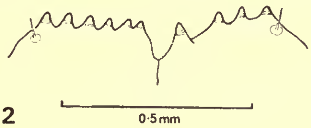

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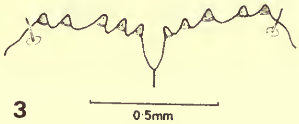

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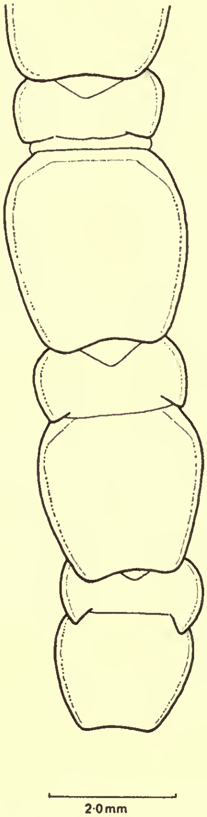

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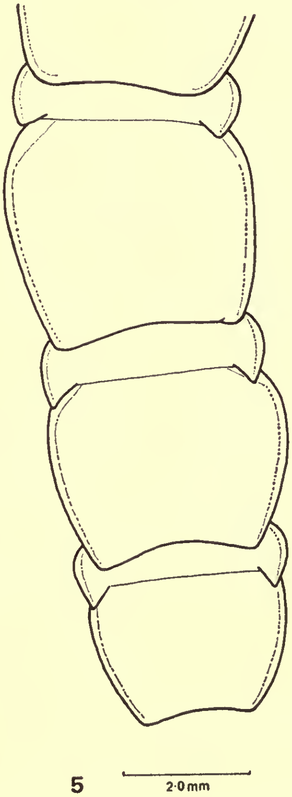

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FIGS 1–5. 1, *Lithobius hardwickei*. Dental margin of prosternum of holotype, ventral. 3, *Lithobius americanus*. Dental margin of prosternum of holotype, ventral. 2, *Lithobius brevicornis*. Dental margin of prosternum of holotype, ventral. 4, *Lithobius elongatus*. 9th to 14th tergites of lectotype, dorsal. 5, *Lithobius monilicornis*. 9th to 14th tergites of male syntype, dorsal.

4. ***Lithobius sloanei*** Newport

Lithobius Sloanei Newport, 1844, p. 96; 1845 (1844–45), p. 369

Type locality. Unknown.

Type specimen. *Holotype*: a bleached and distorted female of *L. pilicornis* about 30 mm long, dried and pinned, labelled "L. Sloanei Newp." in Newport's hand and "Sir H. Sloane's coll. ?4167" on a separate ticket. British Museum (Natural History).

Remarks. This specimen was described and discussed by Pocock (1891a) who identified it correctly and noted that the number 4167 corresponds to the following entry in Sir Hans Sloane's catalogue—"a middling good sized brown Scolopendra".

5. ***Lithobius castaneus*** Newport

Lithobius castaneus Newport, 1844, p. 96; 1845 (1844–45), p. 370

Type locality. Sicily.

Type specimen. *Holotype*: a female 20 mm long, dried and pinned, labelled "L. castaneus Newp." in Newport's hand. British Museum (Natural History).

Remarks. This specimen was examined by Pocock (1890) who recognized its identity with *L. eximius* Meinert, 1872. He noted correctly that it only has 26 antennal articles (Newport gave 41). It agrees with Brolemann's (1930) description of *L. castaneus* except for the presence of the spine 15 VaT which was recorded by Meinert for *L. eximius*, and the extension of the distinctive sculpturing of the large tergites, rather faintly, on to T. 8, 10 and 12: Brolemann described this last feature on T. 1, 3 and 5 only. Other characters possessed by the holotype, all in agreement with Brolemann's description, are 6, 7, 7, 7 oblong coxal pores, lateral spines on the 14th and 15th coxae, and a simple claw on the gonopod with only a feeble lobe at the base of its external ridge and no denticles. These features place it in the subspecies *L. castaneus buchnerorum* described from Ischia by Verhoeff (1942) who assumed that the typical form of the species has a dentate female genital claw (Verhoeff, 1934). However, as Matic (1961) pointed out, many of the subspecies of *L. castaneus* described by Verhoeff were based on unstable characters and are probably without validity: should it be found that a geographical race with a dentate genital claw can be defined it can not be regarded as belonging to the nominate subspecies.

6. ***Lithobius emarginatus*** Newport

Lithobius emarginatus Newport, 1844, p. 96
Henicops emarginatus: Newport, 1845 (1844–45), p. 372

Type locality. New Zealand.

Type specimen. *Holotype*: a very defective female 8·5 mm long, labelled "H. emarginatus Newp." and "in the ground Capt. Ross" in Newport's hand: the specimen has been pinned through T. 7 damaging this and the adjacent tergites, but the pin has been withdrawn and the specimen is gummed to the apex of a triangular piece of card. British Museum (Natural History).

Remarks. Pocock examined this specimen, redescribed the genera *Henicops* Newport and *Lamyctes* Meinert, and removed *emarginatus* to the latter (Pocock, 1901). Archey (1937) also saw the specimen which he described as being 'much shrivelled and somewhat mutilated'. He noted however that the 2+2 prosternal teeth were discernible in the type and it is confirmed that in this as in all other respects the specimen is identical with the common New Zealand species Archey described under *Lamyctes emarginatus*.

7. ***Lithobius rubriceps*** Newport

Lithobius rubriceps Newport, 1845 (1844–45), p. 364

Type locality. Southern Spain.

Remarks. Although Newport deposited his material belonging to this species in the British Museum, no type specimen has been found. It seems significant that Pocock, who examined and reported on most of Newport's type specimens of *Lithobius* in the British Museum, made no mention of *L. rubriceps* in any of his writings: this suggests that the specimen had already been lost or badly damaged before 1890 when Pocock made his first observations.

However, the space in the cabinet containing Newport's specimens and apparently allotted to *L. rubriceps* is occupied by four examples of the common Iberian species known as *L. insignis* Meinert, labelled "Lithobius rubriceps Newport, Lisbon" and "96.3.8.103–106, Pascoe". These specimens were collected by the entomologist F. P. Pascoe and presented to the Museum by Miss Pascoe. They are accompanied by two further specimens of *L. insignis* labelled "Cintra 25.11.96". Newport's description is unmistakable and there is no doubt that these specimens were correctly identified, probably by Pocock, and that *L. rubriceps* is the senior synonym of *L. insignis*.

Meinert (1872) described *L. insignis* and *L. gracilipes* as new species from Spain, suggesting *L. rubriceps* as a possible synonym of the latter. This choice on the part of Meinert is difficult to understand because Newport's description of *rubriceps* is much closer to *insignis* than to *gracilipes*. However, *gracilipes* only differs from *insignis* in being smaller with fewer coxal pores and may well prove to be another synonym of *L. rubriceps*.

The species was fully described by Machado (1952).

8. ***Lithobius fasciatus*** Newport

Lithobius fasciatus Newport, 1845 (1844–45), p. 365

Type locality. Florence and Naples.

Type specimens. *Lectotype*: a specimen labelled "Lithobius fasciatus Newp." in Newport's hand. *Paralectotypes*: two unlabelled specimens accompanying the lectotype. Hope Department of Zoology.

Remarks. These three specimens have been fully described in an earlier paper (Eason, 1970). They were examined by Pocock (1890) who was mistaken in believing them to be identical with *L. grossipes* C. L. Koch.

9. ***Lithobius multidentatus*** Newport

Lithobius multidentatus Newport, 1845 (1844–45), p. 365

Type locality. New York.

Type specimen. *Holotype*: a female 22 mm long labelled as the holotype of *Lithobius multidentatus* Newport by Dr. R. E. Crabill who removed it from the cabinet containing Newport's dried specimens in 1960, relaxed it in trisodium phosphate and placed it in spirit. British Museum (Natural History).

Remarks. Wood (1865) recognized the identity of *L. multidentatus* with the species he had himself described under *Bothropolys nobilis* (Wood, 1863), apparently basing his conclusion on Newport's very brief description. In fact, the holotype has $9 + 9$ prosternal teeth and not $8 + 8$ as Newport stated. The specimen does, however, agree in all respects with Chamberlin's (1925) detailed description of *Bothropolys multidentatus* except for the presence of a small extra medial spur on the left gonopod, in addition to the usual two.

It is clear from Dr. Crabill's labelling of the holotype that he was satisfied as to its identity with the common North American species generally known as *B. multidentatus*.

10. ***Lithobius americanus*** Newport
Fig. 3

Lithobius americanus Newport, 1844 (1844–45), Tab. 33, fig. 29; 1845 (1844–45), p. 365

Type locality. North America.

Type specimen. *Holotype*: a rather defective male of *L. forficatus* (Linn.) 24 mm long, dried and pinned, labelled "Lithobius Americanus Newp. N.S." in Newport's hand. Hope Department of Zoology.

Remarks. Newport distinguished this specimen from *L. forficatus* by its larger size and the form of the prosternum. The teeth of the latter are, indeed, irregularly spaced (Fig. 3) as in so many examples of *L. forficatus*.

Synonymy of *L. americanus* with *L. forficatus* was first proposed by Stuxberg (1871) and has never been disputed.

11. ***Lithobius planus*** Newport

Lithobius sp. Newport, 1844 (1844–45), Tab. 33, fig. 32
Lithobius planus Newport, 1845 (1844–45), p. 366

Type locality. North America.

Type specimen. *Holotype*: a rather defective male of *Bothropolys multidentatus* 18 mm long, dried and pinned, labelled "Lithobius planus Newp." in Newport's hand. Hope Department of Zoology.

Remarks. Newport made no use of the arrangement of the coxal pores in his system and so failed to detect the affinity between *L. planus*, which he believed to be close to *L. variegatus* Leach, and *L. multidentatus*. Further, the holotype of *planus* has 7 + 7 prosternal teeth whereas *multidentatus* was described as having 8 + 8 which is the more usual number in this species. Wood (1863, 1865) mentioned *L. planus* but merely reiterated Newport's description and made no suggestion as to its identity with any North American species known to him.

12. ***Lithobius argus*** Newport

Lithobius Argus Newport, 1845 (1844–45), p. 369

Type locality. Wellington, New Zealand.

Type specimens. *Syntypes*: a female pseudomaturus 18 mm long and a male praematurus 12·5 mm long, both of *L. forficatus* (Linn.), dried and pinned, labelled "Lithobius Zelandicus Newp." in Newport's hand. Hope Department of Zoology.

Remarks. Newport distinguished this form from *L. forficatus* by its smaller size; only the female answers closely to his description.

Pocock (1891b) examined these specimens, noted that they were labelled "*Lithobius Zelandicus*", and confirmed that they belonged to *Lithobius* s.s. but came to no conclusion as to their exact identity. It seems that Newport first named them *Zelandicus* and then changed the name to *Argus* when writing his paper.

This species has never been rediscovered in New Zealand but Archey (1937), in his most recently published account of the Chilopoda of that country, never questioned its validity and regarded Newport's record as evidence of the occurrence of an indigenous species of *Lithobius* in a country where the Chilopod fauna consists otherwise almost entirely of genera confined to the southern hemisphere. There is no doubt that *L. forficatus* was introduced to New Zealand but lack of any subsequent records suggests that it has never become established.

13. ***Lithobius brevicornis*** Newport
Fig. 2

Lithobius brevicornis Newport, 1845 (1844–45), p. 370

Type locality. Naples.

Type specimen. *Holotype*: a male pseudomaturus of *L. forficatus* (Linn.) 17 mm long, dried and pinned, labelled "Lithobius brevicornis Newp." in Newport's hand. Hope Department of Zoology.

Remarks. This specimen has 43 antennal articles, 15 ocelli on each side and 4 + 6 prosternal teeth (Fig. 2), whereas Newport gave 41 articles, 20 ocelli and 6 + 6 teeth. There is, however, no suggestion in the description that it was based on more than one specimen and this description seems, therefore, to have been inaccurate. Newport equated *L. brevicornis* with *L. vesuvianus* Costa, but no account of the latter appears ever to have been published.

Fanzago's (1874) and Fedrizzi's (1877) accounts of *L. brevicornis* are mere reiteration of the original description and Fedrizzi's mention of the antennae as having 14 articles was obviously due to a misprint. Although *L. brevicornis* figures in a number of more recent Italian faunal lists it has never been redescribed and no suggestion has ever been made as to its identity.

14. ***Lithobius melanops*** Newport

Lithobius melanops Newport, 1845 (1844–45), p. 371

Type locality. Sandwich, England.

Type specimen. *Holotype*: a very defective female 13 mm long, dried and pinned, labelled "Lithobius melanops Newp. (Kent 44.41)" in Newport's hand. British Museum (Natural History).

Remarks. Pocock (1890) examined this specimen and concluded that it was conspecific with a common European species widely referred to as *L. glabratus* C. L. Koch 1847. Although the antennae and most of the legs are missing there is no doubt that Pocock was correct.

The species was described fully by Brolemann (1930).

15. ***Lithobius platypus*** Newport

Lithobius platypus Newport, 1845 (1844–45), p. 371

Type locality. Egypt.

Remarks. On the single plate devoted to Myriapoda and Hexapoda—Aptera in the Natural History portion of Savigny's "Description de l'Égypte", figure 3 represents a small lithobiomorph centipede, 11·5 mm long with short antennae each of 20 articles, 1+2, 1 ocelli on each side, no posterior tergal projections and with both 14th and 15th legs thickened. Newport based his description of *L. platypus* on this figure which, with the thickened posterior legs, was unlike any of the larger species of *Lithobius* with which he was familiar. Although, like all Savigny's drawings, this figure is beautifully executed it is inaccurate in that a short tergite is shown immediately behind T. 7; such a tergite is never found in *Lithobius* or any related genus. On the other hand, apart from this spurious tergite, the figure is a very fair representation of *L. vosseleri* Verhoeff, originally described by Verhoeff (1901) from Cyprus and recorded by Silvestri (1929) from a number of localities in North Africa including Alexandria (Egypt). Silvestri referred his specimens to a new variety, *propitia*, on the basis of some quite trivial characters and suggested the possibility of their being identical with *L. platypus*, the only other species of *Lithobius* ever recorded from Egypt.

Savigny's sight failed after he had completed his drawings but before he had finished his manuscript (Sherborn, 1897), so that no names, descriptions or exact localities attaching to his specimens of Myriapoda were ever published. Gervais (1837) commented on Savigny's figure of a lithobiid, but he did not give it a Latin binomen. Newport's description of *L. platypus* may, therefore, be the earliest published description of *L. vosseleri*, but there is no certainty of this and *L. platypus* should be rejected as a *nomen dubium*.

16. ***Lithobius elongatus*** Newport
Fig. 4

Lithobius elongatus Newport in Lucas, 1849, p. 383, Pl. 3, figs. 2, 2a, 2b, 2c and 2d

TYPE LOCALITY. Lac Tonga, Lac Houbeira and La Calle, Algeria.

TYPE SPECIMENS. *Lectotype*: a male 24 mm long, preserved in spirit, labelled "Lithobius elongatus Newport, Algerie Lucas" is here formally designated as the lectotype. *Paralectotypes*: a distorted male about 28 mm long and two males 19 mm long accompanying the lectotype but now placed in a separate tube. Muséum National d'Histoire Naturelle.

REMARKS. Newport's description of *L. elongatus* is inadequate by modern standards but this species was more fully described by Verhoeff (1891) under *Lithobius* (*Polybothrus*) *koenigi* and by Silvestri (1896), in both instances from Tunisian specimens agreeing in all essentials with the lectotype. Later Silvestri (1897) described more specimens from Sicily and proposed *elongatus* and *koenigi*, together with *L. impressus* C. L. Koch and *L. monilicornis* Newport, as junior synonyms of *L. nudicornis* Gervais. *L. nudicornis*, however, is based on an extremely scanty description of a specimen from Sicily (Gervais, 1837) and the name has been rejected by most authors in favour of *elongatus*. Whether *impressus* and *monilicornis*, which are usually accepted as synonyms of *elongatus*, should in fact be regarded as such is open to question and will be discussed under the next species. Owing to the uncertainty as to the relative status, not only of *elongatus* and *impressus* (=*monilicornis*) but of the numerous subspecies which have been described from time to time, the lectotype of *L. elongatus* is described below.

DESCRIPTION OF LECTOTYPE. *Size*: 24 mm long, 2.75 mm broad at T. 10, 15th legs 8 mm long. *Colour*: bleached with little pigmentation. *Antennae*: 10 mm long with 44 articles. *Ocelli*: apparently 1+4, 4, 3 but difficult to see owing to bleaching. *Prosternum*: with 5+5 faintly pigmented teeth; lateral spines appearing as unpigmented nodes, each surmounted by a transparent peg, but before bleaching occurred the lateral spines would, like the teeth, have been strongly pigmented and would have been counted as teeth by Newport. *Tergites* (Fig. 4): posterior angles of T. 9 right-angled, those of T. 11 and 13 with projections; T. 10 and 12 longer than broad with rounded posterior angles. *Coxal pores*: numerous with no regular arrangement.

Spinulation:

	Ventral					Dorsal				
	C	t	P	F	T	C	t	P	F	T
14	a	m	amp	amp	a	a	—	amp	p	p
15	a	m	amp	am	a	a	—	mp	p	—

14*th prefemur*: slightly expanded distally without any conspicuous setal tuft. 15*th prefemur*: with an ill-defined dorsal longitudinal sulcus and a moderate internal distal expansion bearing numerous setae; DpP placed immediately distal to the setae. 15*th apical claw*: simple. *Gonopods*: short and inconspicuous.

Further specimens. In addition to the lectotype and three paralectotypes in the Muséum d'Histoire Naturelle there are five males and two females, dried and pinned, in the British Museum (Natural History) labelled "Lithobius elongatus Newp." in Newport's hand and "Tunis, 46, 103" on a separate ticket, all of which answer essentially to the above description. The same may be said of a female from Tunis (B.M.(N.H.) Reg. no. 90.12.16.23) preserved in spirit along with other specimens of "*L. impressus*" collected by Dr. Anderson in North Africa and reported on by Pocock (1892).

None of these specimens has posterior projections on T. 9 and the number of their antennal articles varies from 39 to 44. Of variations in spinulation, 14VpT, 14VmT and 15VpF may be present; 15VaF, 15VaT, 15DpP and 15DpF may be absent. Neither 15DaP nor ventral tarsal spines, both of which are found in the next species, were present in any of the above specimens.

17. ***Lithobius monilicornis*** Newport

Fig. 5

Lithobius monilicornis Newport in Lucas, 1849, p. 384, Pl. 3, figs 3, 3a, 3b, 3c and 3d

Type locality. Boudjaréa, near Algiers.

Type specimens. *Syntypes*: a male 30 mm long, a rather defective female 35 mm long and an immature female 16.5 mm long, all of *Eupolybothous impressus* (C. L. Koch), preserved in spirit, labelled "Lithobius monilicornis Newport, Algerie Lucas". Muséum National d'Histoire Naturelle.

Remarks. Newport distinguished this species from *L. elongatus* by its more numerous antennal articles, smaller prosternal teeth, relatively broader T. 8, 10 and 12, and longer legs. All these features are shown by the above specimens which are undoubtedly identical with the form described from Oran and Algiers by L. Koch (1862) under *L. impressus* C. L. Koch, and we have no reason to doubt their identity with *L. impressus* as originally described from the Algerian coast by C. L. Koch (1841) and later figured by the same author (C. L. Koch, 1863).

More distinctive than the characters given by Newport for distinguishing this form from *L. elongatus* are the posterior projections on T.9 (Fig. 5) and the presence of ventral tarsal spines on the 14th and 15th legs, both of which were mentioned by L. Koch in his description of *L. impressus*.

Synonymy of *L. monilicornis* with *L. impressus* was first tentatively suggested by Meinert (1872).

Description of male. *Size*: 30 mm long, 4 mm broad at T. 10, 15th legs 12 mm long; if it were not for the contraction of the trunk (Fig. 5) contrasting with the extension of that of the lectotype of *L. elongatus* with exposure of the intersegmental membranes (Fig. 4), the difference in length between these two specimens would be more marked. *Colour*: more bleached than the lectotype of *elongatus* with practically no pigmentation. *Antennae*: 15 mm long with 42 and 43 articles; they appear to have been damaged and to have undergone imperfect regeneration; the adult female has 49 and 52 antennal articles. *Ocelli*: not seen owing to bleaching.

Prosternum: with 6+6 teeth, faintly pigmented at their apices; being more numerous than in *elongatus* they appear relatively smaller; lateral spines appearing as unpigmented nodes but before bleaching occurred they would, like the teeth, have been strongly pigmented and would have been counted as teeth by Newport. *Tergites* (Fig. 5): posterior angles of T. 9 with small but distinct projections, those of T. 11 and 13 with more marked projections; T. 10 and 12 broader than long with posterior angles blunt, not rounded. *Coxal pores*: numerous with no regular arrangement.

Spinulation:

	Ventral						Dorsal				
	C	t	P	F	T	Ta	C	t	P	F	T
14	a	m	amp	amp	am	a	a	—	amp	p	p
15	a	m	amp	am	a	a	a	—	am	p	—

14*th prefemur*: slightly expanded distally without any conspicuous setal tuft. 15*th prefemur*: with a well-marked dorsal longitudinal sulcus and a prominent internal distal expansion bearing numerous setae and a distinct node. 15*th apical claw*: simple. *Gonopods*: short and inconspicuous.

FURTHER SPECIMENS. In addition to the three syntypes in the Muséum d'Histoire Naturelle a female, dried and pinned, in the British Museum (Natural History) labelled "L. impressus C. Koch" and "96.3.8.107 Pascoe, Oran" and a number of specimens from various localities in Algeria (B.M.(N.H.) Reg. nos. 90.12.16.20–22 and 24–28; 91.1.18.1–3), preserved in spirit and constituting the majority of the specimens of "*L. impressus*" collected by Dr. Anderson in North Africa and reported on by Pocock (1892), all answer essentially to the above description. They all have posterior projections on T. 9, the number of their antennal articles varies from 43 to 50 and in addition to possessing ventral tarsal spines on the 15th and usually also the 14th legs, 15 DaP is always present whereas 15 DpP is found only in females.

DISCUSSION. If the specimens mentioned so far in this paper under *L. elongatus* (see p. 208) and *L. monilicornis* (=*impressus*) were the only ones available for examination one would have little hesitation in referring the two forms to distinct subspecies or even to distinct species, but of Dr. Anderson's North African specimens of "*L. impressus*", those from Constantine (B.M.(N.H.) Reg. no. 91.1.18.4–7) are intermediate between the two both as regards the shape of the tergites and spinulation, so it seems that the characters separating *elongatus* and *impressus* are unstable. Neither *Polybothrus elongatus* nor *P. elongatus koenigi* as briefly described by Brolemann (1932) from North Africa can definitely be referred either to *elongatus* or to *impressus* as defined in the present study, but *Lithobius* (*Polybothrus*) *elongatus* var. *oraniensis* described by Verhoeff (1901) from a number of localities in the neighbourhood of Oran seems definitely to belong to *L. impressus*. *L.* (*Polybothrus*) *impressus corsicus* Léger and Duboscq (1903), reported from Corsica and the Maritime Alps (Brolemann, 1930), agrees with *impressus* in having posterior projections on T. 9 and ventral tarsal spines on the 15th legs, but is distinguished by 14DpP being replaced by a hook. Of the other six described subspecies, all either from the western Mediterranean islands or the European mainland, none can be easily placed.

The species or species group to which all these forms belong is clearly in need of revision but, in spite of the intermediate examples from Constantine, it seems advisable to retain, for the time being, the distinction between *elongatus* and *impressus* which belong to the genus *Eupolybothrus* Verhoeff and the subgenus *Allopolybothrus* Verhoeff as amended by Jeekel (1967); but they should be regarded as only subspecifically distinct.

The respective ranges of these two subspecies, if indeed they are true subspecies, are difficult to define exactly. C. L. Koch's figure (C. L. Koch, 1963: fig. 105) is almost certainly of *E. impressus impressus* but it was drawn from a specimen from Bône which is only 80 Km west of La Calle near the Tunisian border, one of the type localities of *E. impressus elongatus.* The latter, however, seems to be confined in North Africa to Tunisia and eastern Algeria whereas *E. i. impressus* extends along the Algerian coast westwards to Oran and probably further into Spanish Morocco.

18. ***Lithobius lucasi*** Newport

Lithobius Lucasi Newport in Lucas, 1849, p. 385, Pl. 3, figs 1, 1a, 1b, 1c and 1d

TYPE LOCALITY. Lac Tonga and Lac Houbeira, Algeria.

TYPE SPECIMENS. *Syntypes*: a male 28 mm long, a female 23 mm long and an immature male 17·5 mm long, all of *L. castaneus,* preserved in spirit, labelled "Lithobius Lucasii Newport, Algerie Lucas". Muséum National d'Histoire Naturelle.

REMARKS. Newport's mention of 5+5 prosternal teeth, the only character appearing to distinguish *L. lucasi* from *L. castaneus,* is hardly surprising because, although the stout lateral spines which Newport, no doubt, regarded as teeth are quite distinct in all three of the above specimens, the 2+2 small teeth are only evident in the immature male: in both the adult syntypes the dental margin of the prosternum is twisted and distorted giving the impression of a series of projections which might be mistaken for teeth. As in the holotype of *L. castaneus,* the type specimens of *L. lucasi* have oblong coxal pores, lateral spines on the 14th and 15th coxae, and the female has a simple claw on the gonopod with only a feeble lobe at the base of its external ridge and no denticles: these specimens, therefore, answer to Verhoeff's (1942) description of *L. castaneus buchnerorum.*

Brolemann (1921) suggested *L. lucasi* as a possible synonym of *L. castaneus*: he was probably guided by Newport's figure (1849: Pl. 3, fig. 1) which leaves little doubt as to its identity.

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TABLE I
Summary of the species described by Newport in the genus *Lithobius*

Nominal species	*Date*	*Type locality*	*Location of type material*	*Validity and status*	*Generic classification*
L. americanus	1844	North America	Holotype; Hope Department	=*L. forficatus* (Linn., 1758)	
L. argus	1845	Wellington, New Zealand	Syntypes; Hope Department	=*L. forficatus* Syn. nov.	
L. brevicornis	1845	Naples	Holotype; Hope Department	=*L. forficatus* Syn. nov.	
L. castaneus	1844	Sicily	Holotype; British Museum (N.H.)	valid	*Lithobius*
L. elongatus	1849	Lac Tonga, Lac Houbeira, La Calle (Algeria)	Lectotype, paralectotypes; Muséum d'Histoire Naturelle	? subspecies of *E. impressus* (C. L. Koch, 1841)	*Eupolybothrus* (*Allopolybothrus*)
L. emarginatus	1844	New Zealand	Holotype; British Museum (N.H.)	valid	*Lamyctes*
L. fasciatus	1845	Florence, Naples	Lectotype, paralectotypes; Hope Department	valid	*Eupolybothrus* s.s.
L. hardwickei	1844	Singapore	Holotype; British Museum (N.H.)	=*L. forficatus* Syn. nov.	
L. leachi	1844	Europe	Holotype; British Museum (N.H.)	=*L. forficatus*	
L. lucasi	1849	Lac Tonga, Lac Houbeira (Algeria)	Syntypes; Muséum d'Histoire Naturelle	=*L. castaneus* Newport 1844	
L. melanops	1845	Sandwich, England	Holotype; British Museum (N.H.)	valid	*Lithobius*
L. monilicornis	1849	Boudjaréa, Algeria	Syntypes; Muséum d'Histoire Naturelle	=*E. impressus*	
L. multidentatus	1845	New York	Holotype; British Museum (N.H.)	valid	*Bothropolys*
L. pilicornis	1844	England	Holotype; British Museum (N.H.)	valid	*Lithobius*
L. planus	1845	North America	Holotype; Hope Department	=*B. multidentatus* (Newport, 1845) Syn. nov.	
L. platypus	1845	Egypt	none	*nomen dubium*	
L. rubriceps	1845	Southern Spain	none	valid =*L. insignis* Meinert, 1872 Syn. nov.	*Lithobius*
L. sloanei	1844	none	Holotype; British Museum (N.H.)	=*L. pilicornis* Newport, 1844	

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A RE-EXAMINATION OF THE CHESTNUT-SHOULDERED WREN COMPLEX OF AUSTRALIA

By C. J. O. HARRISON

SYNOPSIS

THE chestnut-shouldered wren complex within the genus *Malurus* is re-examined, using recently collected material. Seven forms are recognized—*elegans*, *pulcherrimus*, *lamberti*, *assimilis* (including *mastersi* and *bernieri*), *rogersi*, *dulcis* and *amabilis*. Variations occur within *assimilis*, *rogersi* and *amabilis*. Some variant individuals from the northern edge of the range of *assimilis* show aspects of plumage colour approaching those of other nearby forms. The type of distribution appears to provide an example of the refuge concept suggested by Keast. It is suggested that *pulcherrimus* originated in the Eyre peninsula region and *assimilis* in the Hamersley region, and that adaptation to warmer and drier conditions enabled these forms to spread with subsequent climatic amelioration. A wide tolerance of habitat is shown by *assimilis*. Other forms appear to have more specific preferences but may be occupying the ecological equivalent, within their range, of the general habitat required. Evidence of interaction and difference between forms indicates that *elegans* and *pulcherrimus* behave as good species.

The taxonomic status of the other five forms appears to be equal, but whether this should be specific or subspecific must remain undecided until there is more information on distribution and possible interbreeding.

Certain broad trends in plumage colour and size are apparent. The blue wrens appear to have originated as forest birds, probably in the New Guinea region, and to have evolved dull female and male eclipse plumages for crypsis. It is suggested that the dull plumage on the crowns of breeding males of *assimilis* may represent a similar trend.

INTRODUCTION

When the accumulated specimens of blue wrens, *Malurus* species, collected during the five phases of the Harold Hall Australian Expedition were examined for completion of the final report, a re-examination was made of the forms within the chestnut-shouldered wren complex. The last revision had been that of Mack (1934). Seven forms are recognized in the present study (Map 1), these having been assigned various taxonomic ranks during the past. In order to avoid any prior assumption of taxonomic status a single specific or subspecific name has been used in referring to each population in the following account. In addition to specimens collected on the expedition, material already in the collection of the British Museum (Natural History) and specimens borrowed from various Australian museums have been used.

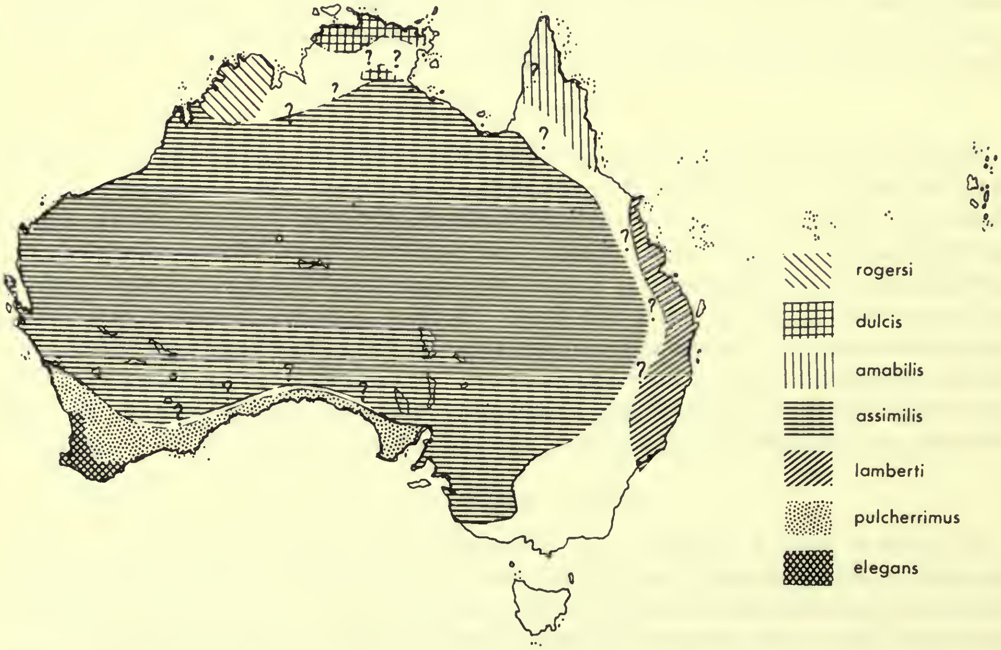
COMMON CHARACTERS

All birds of both sexes have blue colouring, often rather dull, on the rectrices. Males in breeding plumage have a black rump, a broad black collar posterior to the ear-coverts and extending round the nape, and black lores. They also have scapular patches of rather long chestnut-red feathers, the depth of colour on these tending to vary with the intensity of the general plumage colour. The pale edges of the tertials are also tinted chestnut-red. When not breeding males moult into an eclipse plumage similar to that of females and immature birds of both sexes. I have used the term "eclipse" plumage in preference to "non-breeding" plumage since in some species of *Malurus* apparently adult males in breeding condition have the plain plumage and are capable of breeding while in this plumage; thus while the bright male colouring is undoubtedly a breeding plumage the converse is not always true.

The plumage of females, immature birds, and eclipse males is plain brown or blue-grey, according to the form. In those forms in which females have chestnut-red on the lores and around the eyes, similar colour is present on immature birds of both sexes. In these forms adult males do not regain this chestnut-red colour on the lores after the first breeding plumage, although there may be some chestnut-red on a few feathers immediately around the eye.

In moulting into the full breeding plumage, males of *elegans* and *pulcherrimus* appear to acquire the full black lores while still otherwise in eclipse plumage, after which bright blue feathers appear first immediately around the eye. The former character was not apparent on a large series of specimens of *assimilis* and a few of *lamberti* and *rogersi*, save for one brown-plumaged male specimen of *assimilis* with completely black lores.

Except in *amabilis*, females and immature birds have reddish-brown bills. Males in breeding condition have black bills, but may show some brown on a dark bill



Map 1. The ranges as indicated here are very tentative and should be regarded only as a generalized diagram for the purpose of discussing relationship. The question marks indicate regions where the ranges are in doubt, and within the areas shown populations might be small and scattered.

when in non-breeding plumage; while immature males approaching maturity show an increasing spread of black.

Certain broad tendencies are apparent over the chestnut-shouldered wren group as a whole. South-western birds tend to have purple breasts, north-eastern birds to have white lores, northern birds to have blue-grey females and eclipse males, and eastern birds to be bluer and less violet. Birds tend to become larger towards the northerly and southerly limits of distribution.

FORMS OF THE CHESTNUT-SHOULDERED WRENS

Seven forms are recognized here and the accompanying table shows the major differences in plumage between these. The forms are as follows.

	Lores of ♀	*Plumage of ♀*	*Flank of ♂*	*Breast of ♂*
elegans	chestnut-red	rufous-brown and greyish-brown	pale buff	blue-black
pulcherrimus	chestnut-red	olivaceus-brown	pale buff	dark violet
lamberti	chestnut-red	warm brown	pale buff	black
assimilis	chestnut-red	light brown	pale buff	black
rogersi	chestnut-red	light blue-grey	white or greyish	black
dulcis	white	light blue-grey	white or greyish	black
amabilis	white	dark blue	very pale buff	black

1. *elegans*. The Red-winged Wren.

This is restricted in distribution to the extreme south-west of Western Australia, where it is found in thick cover associated with swamps, streams and lakes in areas between Gingin and Warriup.

The male is the palest of these forms, being medium blue on crown and nape, gradually changing on the sides of the head to very pale azure blue: paler still on the ear-coverts where it has been described as "silvery". The back is an even paler and more azure tint. The breast is blackish but with a strong violet tint producing a blue-black colour; the latter most apparent when the bird is viewed frontally with the bill raised and light falling directly on the underside, the breast appearing deep violet with a black band along its lower edge. The hind-flanks and under tail coverts are tinted with pale buff. The female is dark greyish-brown on the head, and dark rufous-brown on the back and wings. Below it is light greyish-buff on throat and breast and pale buff on belly and flanks. The lores are deep chestnut-red.

2. *pulcherrimus*. The Blue-breasted Wren.

This form appears in a zone north of that of *elegans* and mostly south of that of *assimilis*. Its western limits are between the mouths of the Murchison and Namban Rivers and its range extends through the mallee and wheatbelt in a south-easterly zone to Warriup and Eucle, with an apparently isolate population on the Eyre Peninsula.

The male is a deep violaceous blue on the head and deep violet on the back. The forehead and sides of the head are more blue, becoming light blue on the ear-coverts.

The breast is glossy dark violet, brighter towards the edges of the sides, and with a narrow black band along its lower edge. The flanks and under tail coverts are a drab light buff. The female is dull olivaceous brown, with chestnut-red lores. Below, the throat and breast are pale greyish-buff, the belly white, and the flanks and under tail coverts light buff.

3. *lamberti*. Usually regarded as the eastern form of the Variegated Wren, *assimilis;* but sometimes called Lambert's Wren.

This form occurs on the eastern seaboard, and the range appears to be the region east of the Great Dividing Range, south to Sydney and north at least to the Brisbane region, although there appears to be little evidence of what occurs near the coast north of this. Further inland, specimens collected by Elsey (Macdonald and Colston 1965) on the Belyando River are certainly *assimilis* and the latter is said to have been collected on the Dawson River (White 1916). These rivers, although inland in the complex topography of the Dividing Range in mid-Queensland, drain towards the east. Two female specimens collected at Bloomsbury, near Prosperine, on the Wilkins Expedition (allowing for foxing and comparing them with material taken elsewhere on the same expedition) are of the *lamberti* form, suggesting that the latter extends well up the east coast.

Males of this form are deep blue, but not violet-blue, on the back and nape; becoming paler blue on forehead, sides of head and ear-coverts, the last having, in comparison with other light blue plumage, a slight azure tint. There are violet tips to feathers bordering the sides of the black breast. Posterior flank feathers are pale buff. Females, immature birds and males in eclipse are brown above, tinted with warm buff on the rump; pale below with yellowish buff on flanks and belly; and have deep chestnut-red on the lores and a narrow ring round the eye. The brown colour on these birds is darker and warmer in tint than that of *assimilis*.

4. *assimilis*. The Variegated Wren.

This form appears to occur from the Great Dividing Range and its ancillary ranges in Queensland, westwards across the entire dry central region to the west coast, north to the Gull of Carpentaria, the Roper River, and the Broome Area of Western Australia, and south to the edges of the range of *pulcherrimus* but apparently not as far as the south coast.

Males are violet-blue on the back, nape and crown, grading into deep blue on the forehead and light blue, often slightly azure, on ear-coverts and around the eye. Some individuals are less violet dorsally, lighter blue on the head, and more azure on the ear-coverts. The posterior flanks are pale buff. There are violet tips to feathers bordering the sides of the black breast. Of 33 adult males apparently in full breeding plumage and not moulting, 17 showed an area of dull brownish colour on the crown on the head, often resembling a distinct but irregular cap. Another five show traces of this and only 11 have fully-coloured heads. Females, immature birds and males in eclipse are a dull, light brown above, with a buffish rump. Below they are pale buff, deepest on the flanks and almost absent from the throat Adult males in this plumage, in addition to lacking the chestnut-red lores present on the others, are much whiter below.

5. *rogersi.* Usually regarded as the Western form of the Dulcet or Lavender-flanked Wren, *dulcis.*

From specimens collected, and from others kindly lent by the Western Australian Museum, this form occurs in the ranges of the Kimberleys from the Leopold Range north to Napier Broome Bay and westward to the Ord River.

Dorsally males of this form are virtually indistinguishable from those of *assimilis*, but do not show the extreme violaceous tint of some individuals of the latter and tend to come about the middle of the range of variation of the blue and violet colours. There is some individual variation. The wing feathers, both flights and coverts, are a darker brown than those of *assimilis* and may show a faint bluish sheen. This is apparent in fresh plumage, but an otherwise moulted male specimen showed old wing feathers of a similar, sandier brown colour to those of *assimilis*, with just a few darker new feathers. There are violet tips to feathers bordering the breast. The belly and flanks are white, and of ten specimens only one shows a faint greyish wash with even fainter violet tint which might have given rise to the vernacular name. In the circumstances it would seem more correct to call this species "White-flanked "rather than "Lavender-flanked" if it is desirable to refer to this aspect of the plumage.

Females, immatures and males in eclipse plumage all have a dorsal plumage of dull blue-grey, becoming paler blue on the sides of the head and neck. Males are more blue and less grey, and very young birds are greyer, with a hint of brown, and less blue. Wing-coverts are dark brown with greyish edges. Both females and immature males show the chestnut-red lores that substantiate Mathew's *rogersi.* Females show a very pale buff tint on the underside, while males in eclipse plumage are almost white below.

6. *dulcis.* The typical Dulcet or White-flanked Wren.

This form is usually said to have a rather restricted distribution between the Mary and King Rivers (the northern King River), in Northern Territory; (Storr 1967). Humphries (1947) refers to *M. amabilis* [=*dulcis*] being observed on one occasion at Melville Bay, and more recently Rix (1970) has recorded this species at Elsey Creek on the upper Roper River. It therefore seems possible that its true range may be around, or through, the Arnhem Land Region.

Males appear almost indistinguishable from *rogersi* but in fresh plumage appear to show a more obvious bluish wash on the wing feathers, particularly the coverts, making these appear darker in colour. Females and immature males differ from *rogersi* in being slightly darker dorsally, but more conspicuously in having the lores and a narrow ring round the eye creamy-white and not chestnut-red. Ventrally the very pale buff colour is apparent but is combined with a faint grey tint to give the plumage of the underside a rather drab appearance.

7. *amabilis.* The Lovely Wren.

This is another form with apparently limited distribution, occupying habitats bordering the rainforest along the north-east Queensland coast between Cape York and Cardwell, but it has also been recorded (Thompson 1935) from the Gulf coastal regions on the Lower Edward River where it was noted and collected in "dense dry scrubby country on raised beaches".

Males are most similar to *lamberti*, but are a lighter, clearer blue on the back and head, without any definite violet or azure tints, the ear-coverts being similar in colour to the rest of the head. The violet tips to feathers at the sides of the breast are restricted to a few vestigial tips. The flanks show some pale buff. The pale edges to wing feathers show a more distinct blue wash, and these feathers are otherwise very dark in colour, in some instances practically black, and in the case of the lesser coverts usually black.

Females, immature males and males in eclipse resemble those of *dulcis* in having creamy-white lores and eye-rims, but differ in the much darker colour of the dorsal plumage. The latter is a dark and rather dull blue, becoming a little lighter on the forehead, and with conspicuous light blue ear-coverts. Both females and males in eclipse show black bases to the feathers across the upper mantle which are wholly black in the breeding males. The bill is black in both sexes. Wing feathers are dark with a dark blue wash. Below the plumage is very pale buff, whiter on the throat, and whiter overall on males. The juvenile is browner and less blue on the back, and has a dark, blackish-brown bill.

VARIATION WITHIN FORMS

Individual variation is apparent within *assimilis*, *rogersi* and *amabilis*. It is *assimilis*, with its very extensive range, which shows the greatest variation. Individuals showing some variation were described as new races and originally nine were recognized within the range of this form, but these were reduced by Mack (1934) to three (Map 2). On the basis of the material examined, I cannot agree that there are three readily recognizable subspecies within this area, but there is some tendency toward broad trends in colour variation within the very large range occupied by this form.

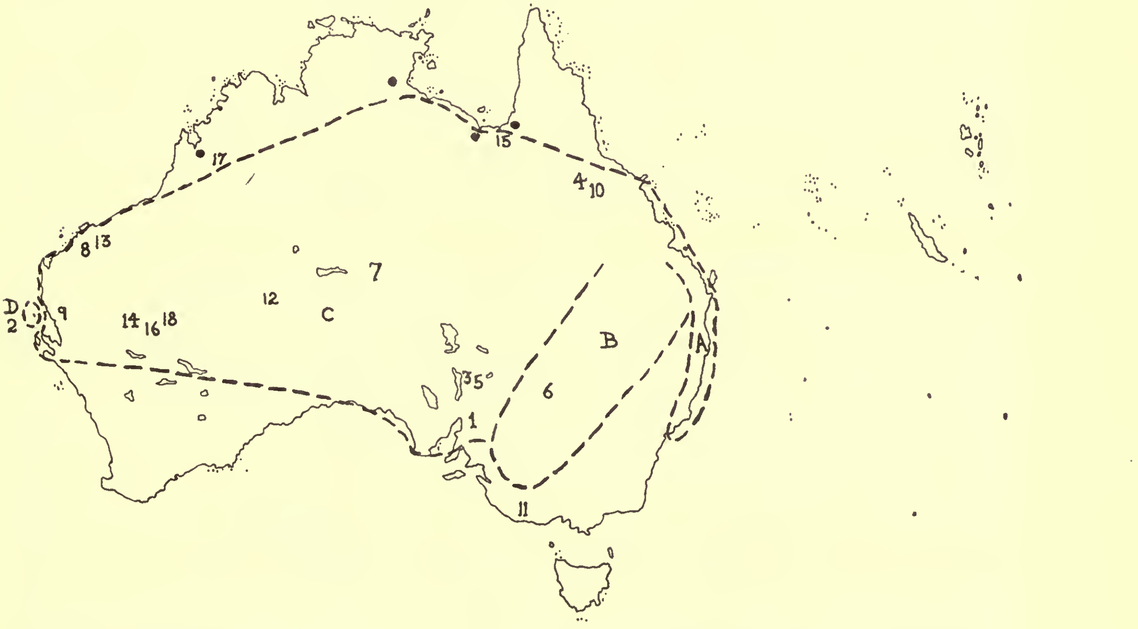
As already mentioned, the only obvious difference is for some individuals to have paler heads. In comparing the blue colour it is necessary to have specimens side by side at the same angle to the light, since the incidence of light can affect the apparent hue of structural colours of feathers.

The original description of *assimilis* was based on one of the darker south-eastern specimens. Grant (1909) described *bernieri*, from Bernier Island off the west coast, differing in that the ear coverts of the male were a dark blue. In a specimen examined they are undoubtedly dark, but match well with those of a specimen from near Lake Frome in South Australia, and one from near Hughenden in northern Queensland. The third race, *mastersi* was described by Mathews (1912) from a specimen from Alexandra, Northern Territory, with more azure blue ear-coverts.

If a dark specimen is compared with a light one the difference is quite obvious, but it was found possible to lay out a series of adult males which showed a consistent gradation of forehead and ear-covert colour, from one extreme to the other, with no division at any point to suggest that more than one population was involved and there was no clear geographical pattern. The specimens, beginning with the deepest colour, were from the following localities:—1, South Australia (unlocalized older specimen, probably from south-east settlement); 2, Bernier Island, W.A.; 3, 30 miles west of Lake Frome, S.A.; 4, near Hughenden, Qld; 5, 15 miles west of Lake Frome, S.A.; 6, Bourke, N.S.W ; 7, Finke River, N.T.; 8, Tambrey, W.A.; 9, Point Cloates, W.A.; 10, Prairie, Qld; 11, Little Desert, Vic,; 12. Warburton Mission, W.A.; 13, Tambrey, W.A.; 14, Upper Gascoyne, W.A.; 15, Moonlight Creek, Qld.; 16, Upper Gascoyne, W.A.; 17, Fitzroy River, W.A.; 18, Upper Gascoyne, W.A. (see map 2).

If one were to follow Mack (1934) nos. 6 and 11 would form his dark subspecies; no. 2 another; nos. 1, 3, 5, 7–9. 12–18 would form a pale subspecies; and nos. 4 and 10 would be part of an indeterminate population. Mack himself appeared uncertain of the precise limits of the forms which he recognized and in his map of subspecific distribution (map 2) did not show precise areas but indicated lobes from a main mass. Condon (1951), in discussing South Australian birds, abandoned head and back colour as diagnostic characters and disagreed with Mack's views on subspecific limits. Ford (1966) noted the variability of the head colouring in Western Australian birds.

There is some evidence of a general tendency for birds with deeper and darker blue colour to occur on the eastern and extreme western edges of the overall distribution, and for paler birds to be most frequent in the desert areas of Western Australia and towards the north-western limits of distribution. Perhaps Gloger's rule



Map 2. The dotted line indicates Mack's version of the distribution of races of *M. lamberti*: A, *M. l. lamberti*; B, *M. l. assimilis*; C, *M. l. mastersi*; D, *M. l. bernieri*. The figures are those indicating individuals in the section on variation within forms. The black dots indicate the localities of variant individuals.

is involved. This clinical trend does not, however, appear to allow convenient subdivision and, in addition, there is evidence of variability between individuals in small areas as well as over a wide range. Nos. 8 and 13 from the above list were collected on the same occasion from the same party of birds, and there are similar variations within specimens from single localities at Fitzroy River, Western Australia, and in northern Queensland. T. Carter (Mathews 1922–3) noted a bird taken on the Minilya River as "blue" on the back, although most individuals from the west coast area were distinctly violet.

Other characters for separation have been suggested. Condon (1951) stated that *mastersi* could be distinguished by its clear white abdomen. This is difficult to determine in the skins of very small birds prepared by a variety of hands, but it was not apparent in the material now examined (46 males) and where some slight difference was apparent it did not relate to the earlier subspecific divisions.

Condon and others also refer to differences in the relative lightness of the brown colour of the wings. The glossy black and blue body plumage appears to be stable but the brown plumage of the wings shows a definite tendency to fade on the living bird and most of the variation apparent in specimens examined due to the differing age of the feathers, the fresh new feathers being darkest. In addition there is some change due to foxing in older specimens. The wing moult and body moult do not appear to be closely synchronised, and birds which show complete breeding plumage on the body may still be actively moulting and growing wing feathers. The relative depth of colour on the wings does not therefore provide a consistent and useful taxonomic character.

The difference in plumage between individuals within *assimilis* are so slight and gradual that there seems no reason to suppose that more than one unit is involved with some local differentiation beginning to occur. I am of the opinion that this should be treated as a single form, and *assimilis* North, 1901, is the oldest name; *mastersi* Mathews, 1919, and *bernieri* Grant, 1909, being synonyms.

Major variation in the Red-shouldered Wren Group

Among specimens of *rogersi* a male from Kulumburu (W.A. Museum, A 8884) was a much lighter blue on the head, and similar in this respect to a specimen of *assimilis* (B.M. no. 1964. 60.585) from Moonlight Creek, north Queensland.

There is some variation in the blue tint of the head of breeding males of *amabilis*. Mack (1934) separated birds from the southern half of the range as a subspecies, *clarus*, on the grounds that they showed lighter blue colouring. An examination of specimens, including some lent by the Queensland Museum, revealed a small difference between extremes. Birds recently collected from Tully were a lighter blue than some early specimens from Somerset and Port Albany, and the latter showed a slight violaceous tint to the deeper blue which was a little more distinct on some northern birds from the Queensland Museum. Recent specimens from Ayton, towards the middle of the range of this form, appeared to be intermediate in character. The total difference appears to be small and clinal in character and on the material at present available I would regard *clarus* Mack, as a synonym of *amabilis*.

VARIANT INDIVIDUALS

In addition to the variations already described there are some variant specimens which, from their appearance and locality, (map 2) may throw some light on the relationship between various forms.

The most conspicuous of these is an adult female *assimilis* (B.M. no 1964.60.578) collected on the Norman River south of Normanton, Queensland, at the south-east corner of the Gulf of Carpentaria. This bird shows a pale greyish tint over the whole body plumage, particularly noticeable on the sides of the head and neck. The lores are the normal chestnut-red colours and the retrices dull blue. There is no suggestion that this variation is due to wear or fading. Normal brown plumage contains both eumelanin and phaeomalenin and these are not differentially affected by exposure to light, (Harrison 1963). The bird was collected from a party of eight individuals and another female and an immature male collected at the same time appear to be normal.

Two other females of *assimilis* (B.M. nos 1969.4.415, 417) show similar, although less marked, tendencies towards greyish plumage. These are the only two females taken on the Roper River, Northern Territory (14° 15′S., 135° 3′ E.). On these the grey tint is superimposed on the normal brown plumage to give a colder, greyer tint, but the sides of the head and neck are noticeably grey, and the rump has an olive tint.

A minor plumage variation found during close examination was the presence of a few dark lesser covert feathers on some males of *assimilis*, the coverts of this form normally being brown. Occasional blackish covert feathers occurred on a male (B.M. no. 1964.60.674) from Norman River, at the same locality as the female described above, but from a different party of birds; and on a male (B.M. no 1964.60.585) from the south of Moonlight Creek, on the south-east of the Gulf of Carpentaria. Males showing some blue tips to feathers occurred at Moonlight Creek (B.M. no 1964.60.581), Roper River (1969.4.414, 416), and at Mount Anderson (1964.4.443, 450) in the south-western Kimberleys.

These variants may be significant in view of their distribution. The greyish females of *assimilis* occur on the edge of its range, in one case near *amabilis* and in the other near *dulcis*, both of which have blue-grey females. The variant wing-coverts similarly occur on individuals on the northern edge of the range, birds with blackish coverts at Norman River and Moonlight Creek being near *amabilis* which has similar coverts; and birds with blue covert tips at Roper River and Mount Anderson being near to *dulcis* and *rogersi* respectively, both of these having blue on the converts. The exception is the second male from Moonlight Creek which has the few covert tips blue and not blackish.

ZOOGEOGRAPHICAL DISTRIBUTION PATTERN

The type of distribution shown by the chestnut-shouldered wren complex appears to provide a good example of the refuge concept suggested by Keast (1961) and to show the utilisation of a greater number of refuges than do the other superspecies groups which he instances. Keast did use these birds as an example but used the races as mapped (map 2) by Mack (1934) and hence found the parallels with other species groups less obvious than they should have been. There is, in fact, a ring of forms, most of which still occupy limited peripheral areas (map 1). On the eastern edge of Australia is *lamberti*, *amabilis* is in the north-eastern peninsula, *dulcis* in the north of Northern Territory, *rogersi* in the Kimberleys of the north-west, and *elegans* in the south-west corner. Since *pulcherrimus* is present on the Eyre Peninsula as well as in the south-west it is more likely that, rather than having evolved in competition with *elegans*, it differentiated in or somewhere near the former region in a refuge demanding tolerance of drier conditions and higher temperatures than did the south-west refuge; and therefore, when conditions ameliorated, it would have been able to spread westwards into similar habitats bordering the range of *elegans*.

The last form, *assimilis*, presents a slight problem. There are several potential refuges which might have been available (Keast, 1961) and are not occupied by other members of this group, but from its present distribution it is reasonable to assume that the differentiation would have occurred in a refuge where conditions were both drier and warmer than in some others. The extreme south-east is therefore unlikely since conditions there are likely to have been both moister and cooler. The two remaining likely areas are the Hamersley region of coastal Western Australia and the central ranges. The differentiation in isolation apparent in other taxa (Keast 1961) occurs less frequently, in the latter area and the Hamersley region would seem the more likely of the two. The adaptation to such a refuge would give this form the slight advantage that would enable it to exploit more rapidly and successfully the gradual amelioration of extremely arid conditions of the central area and to spread to produce the apparent "Eyrean" distribution (Spencer 1898). Keast (1958) has pointed out that many forms with this distribution are derived from western isolates of species with more extensive distribution at an earlier period.

HABITAT PREFERENCE

From the limited distribution of some of these forms, they may have evolved some degree of habitat preference which might limit any subsequent spread. In the south-west *elegans* has a limited distribution in low cover bordering fresh water swamps or streams; while *pulcherrimus* is a species of sandplain scrub and mallee. Of the northern forms, both *rogersi* and *dulcis* occur in regions of ranges and plateaus and appear to be mainly confined to places where the floors and sides of sandstone or granite gorges have low scrubby vegetation and where natural breaks or discontinuities in the rock of the ranges are accompanied by vegetation including low bushes and spinifex. The other extreme is shown by *amabilis* which occurs on the outer edge of rain-forest or in suitable low cover in open forest adjoining it. The information on *lamberti* is poor but it appears to occupy thick, shrubby growth in fairly moist habitats including the thick shrub layer of forest, and in this respect would seem to show some similarity to *amabilis*.

As might be expected from its considerable range, *assimilis* shows a wider habitat tolerance. In general it tends to be a bird of shrubby growth bordering watercourses in drier regions. It may, however, move into the sparse vegetation of sandstone ridges, occupying a similar habitat to *rogersi* and *dulcis* in similar regions, and although from their field observations B. M. Booth and D. Freeman are of the opinion that in such places it is less likely to venture onto bare rock than are the last two forms this would not prevent it from sharing the same cover were it to occur with them. At the other extreme it extends into the shrub growth along rivers and creeks in open forest; and down into thickets, riverine forest and the edges of mangroves.

In Western Australia near Carnarvon, where this form occurs in the scrub on dunes among saltbush, pairs were seen out in the mangroves apparently disputing territory over rising seawater. The mangroves in this area form a narrow belt separated from the beach by a tidal lagoon up to about half a mile wide in places. Within the mangroves, which are low and open on the landward side, becoming taller and thicker to seawards, there are small crescentic beaches with a sparse growth of herbaceous plants. Although it seems likely that the presence of pairs in such a place may have been due to a lack of suitable territories due to overpopulation, and the fact that these were pairs rather than parties suggests that they were young or breakaway units searching for new areas, their presence nevertheless indicates the readiness of this form to attempt to occupy a wide range of habitats.

This wide habitat tolerance in *assimilis* does suggest that the ecological requirements of the birds may be relatively simple and that, at least where the northern forms are concerned, the apparently narrower habitat preference of various other forms may be simply due to the fact that they are occupying the ecological equivalent within a more specialised and less varied biotope. Certainly the habitat tolerance of *assimilis* is such that were it to come into contact with other forms it seems likely that it would occupy the same niche, and the apparent minor variation in habitat would be unlikely to act as a barrier between them.

THE INTERACTIONS AND TAXONOMIC STATUS OF THE FORMS

Where a number of similar allopatric forms exist it is always difficult to determine their precise taxonomic relationship. In the present instance the recognition of five species for the seven forms appears to be an accidental result of the successive description of the forms and their similarity to those already known at the time of their discovery.

The situation in the south-west has been well investigated (Serventy 1951, Ford 1966, 1969). Here *elegans* and *pulcherrimus* have contiguous ranges and *pulcheririmus* and *assimilis* are sympatric in the north-west part of the former's range. Ford (1966) has evidence that these pairs encounter each other in the field; but *elegans* and *assimilis* do not meet. In such encounters these three forms appear to ignore each other and behave as good species. Where *pulcherrimus* and *assimilis* are sympatric they occur in the same biotope and show a mosaic distribution, but it is not certain whether this indicates interspecific intolerance or differing responses to microhabitats (Ford 1966).

The plumage of breeding males appears adequate to ensure specific recognition, the combination of colour on breast, head and back being conspicuously different in the three (table 1). A combination of pale azure and blue-black is present on *elegans*; violet-blue and dark violet on *pulcherrimus*; and lighter violet-blue and black on *assimilis*. These colours would be particularly conspicuous in any frontal displays. The interspecific variation in colour of females, young and eclipse males is relatively slight, but this might aid specific recognition. There may be other differences. Ford (1966) refers to a detectable difference in the voices of *pulcherrimus* and *assimilis*. Size differences are relatively slight, with a clinal increase in a south-westerly direction; and I doubt if the differences in bill-size given by Ford would be sufficient to produce the variation in food selection which he suggests.

The situation is more complicated in the northern half of Australia where there are five recognizable forms—*lamberti*, *assimilis*, *rogersi*, *dulcis* and *amabilis*—previously recognized as three species—*lamberti*/*assimilis*, *rogersi*/*dulcis* and *amabilis*. These five forms show slight size variation of a clinal type, the more northerly being a little larger. Since within the whole chestnut-shouldered wren group size tends to increase towards the northern edge of the distributional range as well as the southern edge it seems inadvisable to suggest the latter as an example of Bergmann's rule.

Apart from this, the characters which differ between forms and could be used for recognition are those of plumage colour. In *Malurus* species generally specific and subspecific variations are usually most apparent in the breeding plumage of the male. In the present group although the dorsal blue colour varies, the range of variation within *assimilis* encompasses that of both *rogersi* and *dulcis*. In sequence from blue to violet-blue the arrangement would be *amabilis*—*lamberti*—*assimilis* (inc. *rogersi* and *dulcis*); the difference between the last two of the three, usually regarded as conspecific, being greater than that between *assimilis* and the forms in parentheses which are regarded as good species.

The only other obviously variable plumage character of breeding males, which has been used for separation of forms, is the flank colour (table 1). The posterior flanks show a variable amount of pale buff on *lamberti* and *assimilis*, slightly buff colouring on *amabilis*, and are usually white, with a purplish-grey wash on some individuals of *rogersi* and *dulcis*. One or two specimens of the last form show a small amount of pale buff, particularly around the upper thighs, but since buff is present on females and eclipse or immature males, this may only indicate incomplete assumption of full male plumage.

The female plumage shows greater distinctiveness in this group, varying between brown and blue-grey; *lamberti* being warm brown, *assimilis* normally a paler, duller brown, *rogersi* and *dulcis* pale blue-grey, and *amablis* deep blue-grey. The apparent clear-cut distinction is blurred a little by the existence of the greyer variant individuals of *assimilis*. If these are included in the sequence there is a much smoother gradation and the most relevant differences would appear to be the darker colour of *amabilis* and the change from chestnut-red lores on *lamberti*, *assimilis* and *rogersi* to white lores on *dulcis* and *amabilis*.

The mainly allopatric distribution makes it difficult to judge the amount of interaction that might potentially occur between these northerly forms. Mack (1934) suggested that *assimilis* and *lamberti* interbred in northern Queensland, but from his account it seems possible that he did not make allowance for variation within *assimilis*, and a more satisfactory investigation of this is still needed. At the opposite extreme of the range of the latter the fifth phase of the Harold Hall Australian Expedition found both *assimilis* and *rogersi* near Mount Bell in the Leopold Range, one of the more level plain and the other in the gorges of the range, but in types of habitat in which they might well encounter each other. Intergrades between the two would be very difficult to identify. Assuming that interbreeding produced individuals with intermediate plumage colour, this would only involve the buff on the flank of the male and the body colouring of birds other than breeding males. Any male bird with buff on the flanks would probably pass as *assimilis*. Intermediates when female or immature should be recognizable and would probably resemble the greyer variant individuals of *assimilis* already described. If these single plumage characters were controlled by a simple pair of dominant and recessive alleles recognition of a hybrid might be impossible.

Rix (1970) has recently recorded a party of *assimilis* in a clump of teatree on Elsey Creek with a party of *dulcis* (referred to by Rix as *amabilis*) in an area of tall grass with a few small shrubs only about twenty yards away. There is therefore a potential zone of interaction between *assimilis* and *dulcis* also; but theoretically none between *assimilis* and *amabilis* (map 1.) However, the presence of variant individuals of *assimilis* apparently showing the plumage character of the other two to some degree, at points in its range nearest to the known ranges of the other two forms, suggests either that the factors responsible for these plumages are environmental ones which may act upon individuals of *assimilis* in the same regions and tend to select for similar characters (although in such circumstances one might expect all individuals in an area to show some evidence of this) or that there is some interbreeding within the areas where the forms approach each other. If the latter is true then it would suggest that the distribution of *amabilis* is more extensive than our present knowledge indicates. To suggest such interaction presupposes that there are not fully effective barriers of ecology or species-specific recognition between the forms. The obvious ecological barrier of habitat preference has already been discussed and it is suggested that the wide habitat tolerance of *assimilis* could potentially bring it into contact with the other forms. Recognition would be based on signals of behaviour, voice or plumage pattern. Such little evidence as we have suggests that these various forms are similar in their behaviour and that their voices are indistinguishable, although in view of Ford's (1966) comment on the voices of two south-western forms a more critical appraisal of this character might be helpful.

In the south-western forms, where plumage colour of the breeding males appears to be a good specific character, adjacent forms show marked variation in the combined colouring of head, back and breast. This suggests that such signal colouring is associated with frontal displays, and such postures have been described (Rowley 1964) in the Superb Blue Wren, *M. cyaneus*, the only adequately studied species. The present forms all have black breasts, with slight variation in the extent of the violet edge at either side. The head and back colouring is indistinguishable and variable in three forms and it is therefore difficult to argue that the slight differences in the shade of blue shown by the other two is of any great significance. The flank colour used to separate forms would not appear to be used in displays and, in some at least, might be actually concealed by the wings. There would therefore seem to be no reason to regard the male breeding plumage as obviously specifically isolating.

An alternative isolating factor would be the recognition by the male of differences in the female colour, the grey or brown plumage, the presence or absence of chestnut-red lores, or the bill colour. Heterogynism—variation in females but not in males—occurs in races of some species but is comparatively rare. Mayr (1942) records it in three races of *Pachycephala pectoralis* in the Solomons, but since these are on different islands the question of recognition or interaction would presumably not arise. Hellmayr (1929) and Zimmer (1931 *et seq.*) also found it in races of some species of Formicariidae in South America, but the implication of this in relation to recognition does not appear to have been examined. There is therefore no useful information on the use of heterogynism in intraspecific recognition. Encounters of forms in which chestnut-red lores are present with those which lack them might produce some confusion since in the forms that possess them the absence of these usually indicates that a bird in brown or blue-grey plumage is an adult male in eclipse. Similarly a black bill on a bird in eclipse plumage usually indicates a male, but females of *amabilis* also have a black bill.

In summary, there are two very distinct forms of the chestnut-shouldered wrens in the south-west which can be regarded as separate species; but the inter-relationships of the remaining five forms are obscure. Each has a slightly different combination of plumage characters. The selection of particular characters for the previous separation of species seems to have been arbitrary, and each form would appear to represent a separate isolated evolutionary unit. The more recent taxonomic treatment of the peripheral rings of isolate forms, of which there are many in the different taxa on the Australian sub-continent, has been to regard these as species, except where secondary re-integration occurs in forms which spread and re-encounter each other, in which case they are regarded as subspecies. A typical example of the latter is Keast's (1961) interpretation of relationship in the Australian forms of *Sittella*.

In the case of the chestnut-shouldered wrens there are five distinct forms of equal standing, all of which could be regarded as specific or near-specific entities. It is possible however that speciation has been incomplete and that they might interbreed and re-integrate freely if they came together again. The extensive spread of *assimilis* has increased the likelihood that this might occur, and the existence of variant individuals suggests that it may be taking place. If subsequent field investigation shows that this is so, and if more detailed study of these forms confirms that there are no barriers, of the type discussed, to prevent this occurring, then it might be preferrable to regard them as subspecies within a single species.

APPARENT EVOLUTIONARY TRENDS

The genus *Malurus* appears to have affinities with a group of genera in New Guinea (Harrison and Parker 1965, Harrison 1969a). The deep blues, black, and chestnut-red of these birds is a colour combination which appears more usually to originate in moist tropical forest; and from this, and from what we know of the general zoogeographical trends within this region, it seems probable that *Malurus* as a unit may have invaded Australia from this direction and subsequently evolved and radiated within the Australian environment. In the New Guinea group as a whole females are similar in plumage colour to males, or as richly coloured. The production of the rather drab female plumage, and of an eclipse plumage in the non-breeding males appears to have occurred in Australia, and it would seem most likely that this is an adaptation for crypsis in a generally more open environment where the more brightly coloured bird is vulnerable to predation. In the case of the Blue-and-White Wren, *M. leucopterus*, there appears to have been a suppression of bright male plumage in subordinate males (Harrison 1969b), the alternative possibility being that of very high predation on males in breeding plumage. The species is one that occurs in arid areas with relatively sparse cover, and the blue and white male is very conspicuous.

In view of this apparent tendency to reduce the conspicuous colour of the males of this taxon in the more open areas, retention of the dull eclipse plumage on the crowns of so many of the collected male specimens of *assimilis* may be significant. With such a bird in its normal posture with tail cocked acutely and head back a little, the back is relatively less conspicuous and to an aerial avian predator the crown of the head must be the most obvious mark. A dull crown might thus carry a strong selective advantage.

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A NEW SPECIES OF *LIRONECA* (ISOPODA; CYMOTHOIDAE) PARASITIC ON CICHLID FISHES IN LAKE TANGANYIKA

By R. J. LINCOLN

INTRODUCTION

Only three species of parasites belonging to the family Cymothoidae have been recorded from freshwater localities on the African continent. The first of these to enter the literature was *Ichthyoxenus expansus*, described by Van Name in 1920 as a parasite on the gills of the citharinid fish *Eugnathichthys eetweldii* Boulenger. This isopod has since been widely recorded from the waters of the Congo river basin (Monod, 1931; Dartevelle, 1939; Brian & Dartevelle, 1949 and Grosse, 1963). There has been much discussion in the past about the validity of the genus *Ichthyoxenus* to which *expansus* was referred. Miers (1880) expressed the opinion that the two genera *Ichthyoxenus* and *Lironeca* were indistinguishable, except that the former was exclusively freshwater. Van Name (1920) considered the wide separation of the localities from which the species of *Ichthyoxenus* had been described as evidence that they were not a monophyletic group, but were instead convergent forms. In this view the freshwater habitat has been adopted independently a number of times by some ancestral marine genus such as *Lironeca*. Monod (1931) also mentions the above points, but despite this the name *Ichthyoxenus* still seems to survive for certain freshwater species. More recently, Fryer (1965) adopts the view that the freshwater species have been derived from some common marine ancestor, and that morphologically they are indistinguishable from the widespread marine genus *Lironeca*. Fryer thus refers *expansus* to *Lironeca*, and considers *Ichthyoxenus* of Herklots 1870 to be a junior synonym of *Lironeca* Leach 1818.

Two further species are described by Fryer from Lake Tanganyika, *Lironeca tanganyikae* Fryer 1965 and *Lironeca enigmatica* Fryer 1968. The former species, *tanganyikae*, has been recorded only from the mouth cavity of the littoral cichlid fish *Simochromis diagramma* (Günther), while *enigmatica* was taken from the body and gill cavity of the clupeids *Limnothrissa miodon* (Boulenger) and *Stolonothrissa tanganicae* Regan.

An examination of a collection of the cichlid fishes *Lamprologus elongatus* Boulenger and *Lamprologus pleurostigma* Boulenger from Lake Tanganyika has provided a number of isopod parasites, with both mature male and female stages present. These specimens represent a hitherto undescribed species which I name *Lironeca africana*.

Lironeca africana sp. nov.

(Text-figs 1a–g, 2a–j, 3a–q)

MATERIAL EXAMINED. Holotype female, length 11·0 mm, ovigerous: allotype male found in association with holotype, length 5·0 mm: paratypes, 5, ♀♀, length 7·0–14·0 mm, width 3·5–5·0 mm; 4, ♂♂, length 4·0–5·5 mm, width 1·0–2·0 mm. All specimens deposited in the British Museum (Natural History), accession numbers; holotype, 1970 : 438; allotype, 1970 : 439; paratypes, 1970 : 440.

FEMALE, (holotype). Body size, length 11·0 mm, width 4·5 mm, height including the marsupium 4·0 mm. Shape of body in dorsal, ventral and lateral view given in Figs 1a, 2a, 1b respectively. Head, ratio of length to maximum width about 1 : 1·5, shape triangular, broadly rounded at the front and curved slightly downwards towards the base of the antennae; eyes large, laterally placed; head somewhat sunken into the peraeon; chromatophores evenly distributed on dorsal side of head. Peraeon tergite 1 about 1½ times the length of tergite 2, tergites 2–6 subequal, tergite 7 only half length of tergite 6; peraeon tergite 1, antero-lateral projection reaching forward to mid-eye level, anterior and posterior margins broadly rounded; peraeon tergite 1 almost flat dorsally, tergites 2–7 becoming progressively more convex; maximum width of peraeon is reached by coxal plates of segment 4; coxal plates reach progressively nearer to posterior margin of tergites from 1–7; posterior margin of peraeon tergite 7 broadly rounded. Pleon immersed a little in peraeon tergite 7, all segments free laterally, length of segments increasing slightly from 1–5; posterior margin of pleon segment 4, and especially 5, sinuous. Telson, length twice width, broadly rounded, with ridge running from antero-lateral corners towards the centre.

Appendages; antenna 1 and 2 each with 7 segments, slender, rounded and only just reaching beyond forward projection of peraeon tergite 1, antenna 1 slightly longer than antenna 2 (Fig. 2b, c); mandible (Fig. 2d) with slender inscisor process pointed at tip, molar process rounded, palp 3-segmented with 2–3 apical setae; maxilla 1 (Fig. 2e) slender, carrying 4 recurved spines on distal tip; maxilla 2 (Fig. 2f) small, bilobed, each lobe bearing a pair of hooked spines; maxilliped (Fig. 2g) well developed, broad, with a 2 segmented palp terminating in 4 strongly recurved spines. Peraeopods 1–7 of similar shape (Fig. 1c, d), basis and ischium strongly developed in anterior peraeopods, less so in posterior peraeopods, merus and carpus very short, propodus prominent, dactylus strongly curved and pointed, apex of dactylus fitting into a carpal groove, very well formed articulation between dactylus and propodus, no spines present on the peraeopods. Pleopods fleshy, leaf-like, without marginal setae (Fig. 1e, f); uropods (Fig. 1g), inner ramus just a little longer than outer, both rami apically rounded, projecting fractionally beyond margin of telson.

MALE, (allotype) found associated with holotype. The male is very much smaller than the female, length 5 mm, width 2 mm; general form of the body and appendages resemble the female, and reference will therefore be made only to the main points of difference. Shape of body in dorsal view as in Fig. 2h. Head with rounded eye lobes, produced forward into a short, somewhat square-ended rostrum, only weakly immersed into peraeon; peraeon slightly asymmetrical, tergite 1 is 1½ times length

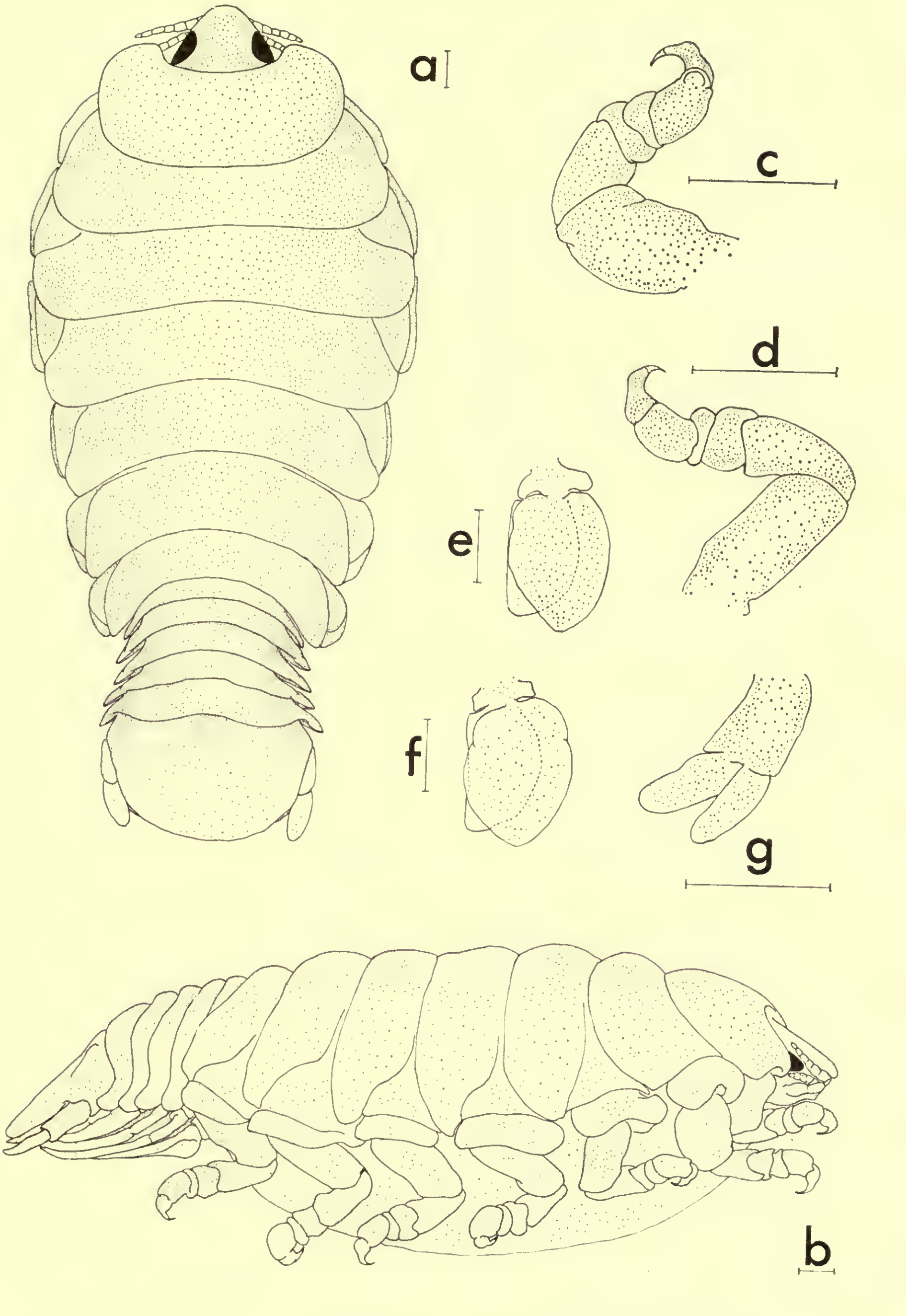

FIG. 1. *Lironeca africana* sp. nov. ♀ Holotype: a, body entire, dorsal view; b, body entire, lateral; c, peraeopod 1 left, ventral view; d, peraeopod 7 left, ventral view; e, pleopod 1 left, ventral view; f, pleopod 2 left, ventral view; g, uropod left, ventral view. Bar scale 1 mm.

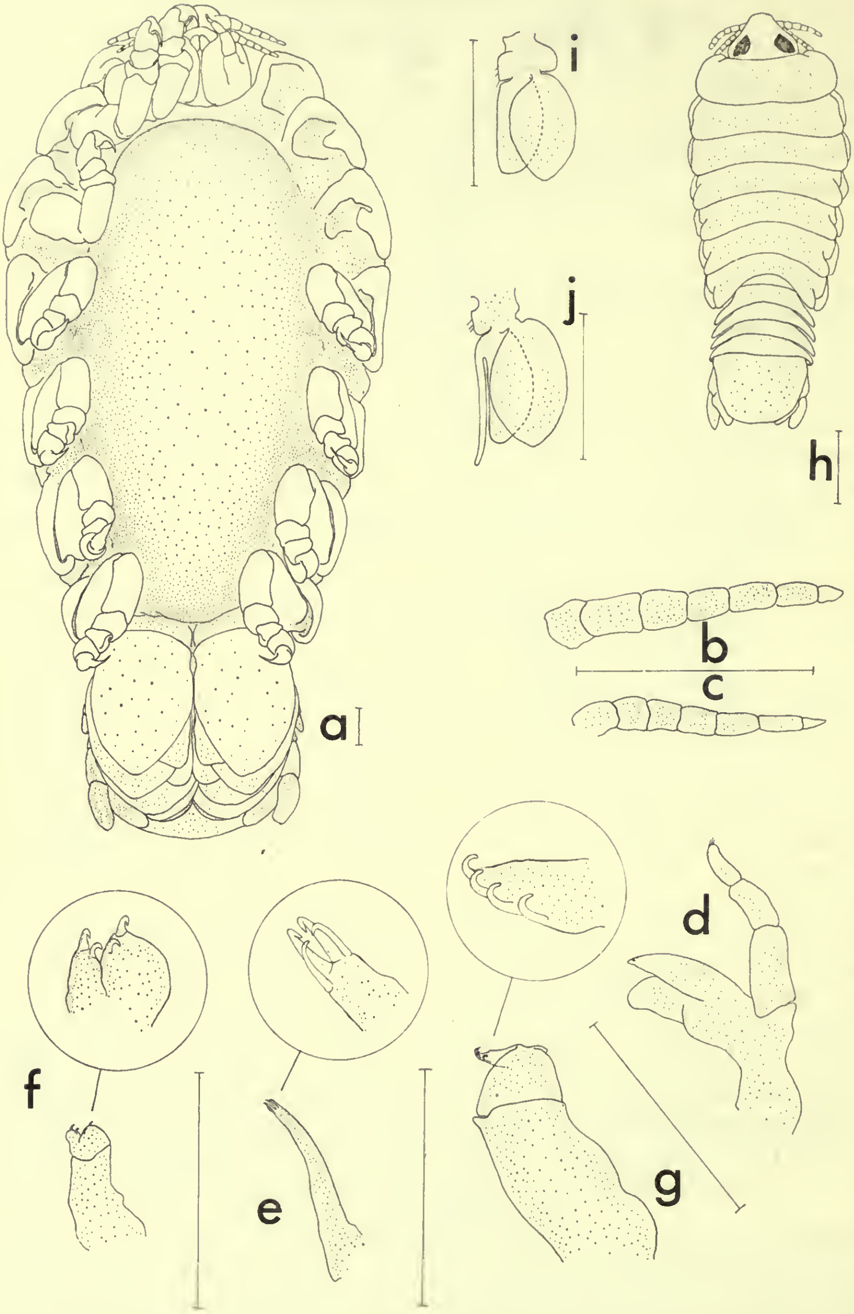

FIG. 2. *Lironeca africana* sp. nov. a–g ♀ Holotype: a, body entire, ventral; b, antenna 1; c, antenna 2; d, mandible, e, maxilla 1; f, maxilla 2; g, maxilliped; h–j ♂ allotype: h, body entire, dorsal; i, pleopod 1, left; j, pleopod 2, left. Bar scale 1 mm.

of tergites 2–7, maximum width at the level of segment 3, posterior margin of tergite 7 deeply rounded; paired penis lobes present on ventral surface of peraeon segment 7; chromatophores on both dorsal and ventral surface of peraeon; body less convex than the female. Pleon segment 1 immersed laterally in peraeon, segments 2–5 free; telson broad and flat, length about half of width, posterior corners round becoming straight in the centre.

Appendages; antenna 1 (Fig. 2h) rounded in cross section, 7 segmented; antenna 2 much narrower and consisting of 8 segments; mandible, maxilla 1, maxilla 2 and maxilliped as in female except the apical hooks are much less pronounced; pleopod 2, endopod, bearing appendix masculina (Fig. 2j), pleopod 1, fleshy and leaf-like (Fig. 2i).

First marsupial stage. This is mentioned only briefly as it is the structure of the second marsupial stage which is of greater interest. Body shape as in Fig. 3m; head not immersed in peraeon; peraeon tergite 1 with markedly sinuous posterior margin, segment 7 reduced in size and continuous with pleon; telson long and rounded, no marginal setae.

Appendages; antenna 1 consists of 7 segments, much dilated, without aesthetascs; antenna 2 of 8 segments, slender, slightly longer than antenna 1. Peraeopods 1–6 of similar size (Fig. 3n, o), no hooks or spines present. Pleopods 1–5 fleshy, no marginal setae; uropods projecting well beyond extremity of telson, no marginal setae or terminal spine (Fig. 3p, q).

Second marsupial stage. Body, length about 3 mm, width about 1 mm; 65 young specimens taken from the marsupium of a single female; shape in dorsal view as in Fig. 3a. Head with rounded eye lobes and forwardly produced rostrum as seen in the male; eyes large. Peraeon tergite 1 almost twice length of tergites 2–6, anterior and posterior margin of tergite 1 broadly rounded, segment 7 reduced and continuous with pleon, dorsal side of peraeon flattened; no penis lobes evident. Pleon rectangular, all segments free laterally; telson slightly longer than wide, rounded posterior margin bearing about 13 long plumose setae.

Appendages; antenna 1 (Fig. 3b) rounded in cross section and dilated, 7 segments, of which 4–7 carry prominent groups of aesthetascs; antenna 2 (Fig. 3b) slender, a little longer than antenna 1, 8 segmented with a small group of terminal setae; mandible, maxilla 1, maxilla 2, and maxilliped similar to those of female except much smaller and the terminal hooks evident only as small rounded tubercles. Peraeopods increasing in length very slightly from 1–7, basis and ischium well developed, merus and carpus short, propodus strong, and dactylus long, pointed, and sharply curved; peraeopods 1–3, merus with long spine-like seta on antero-lateral corner (Fig. 3c), also a characteristic number of hooks on inner side of each peraeopod, peraeopod 1–2 with a pair of hooks on propodus (Fig. 3c), peraeopods 3–4 have a pair of large hooks on propodus and a single curved spine on carpus (Fig. 3d), peraeopod 5 with two propodal and two carpal spines (Fig. 3e), peraeopod 6 bears two spines on propodus, three on carpus, and a single one on the merus (Fig. 3f). Pleopods bilobed (Figs 3g–k), leaf-like with long marginal plumose setae, setae absent from endopods of pleopods 3–5; peduncle of pleopods 1–5 each with a

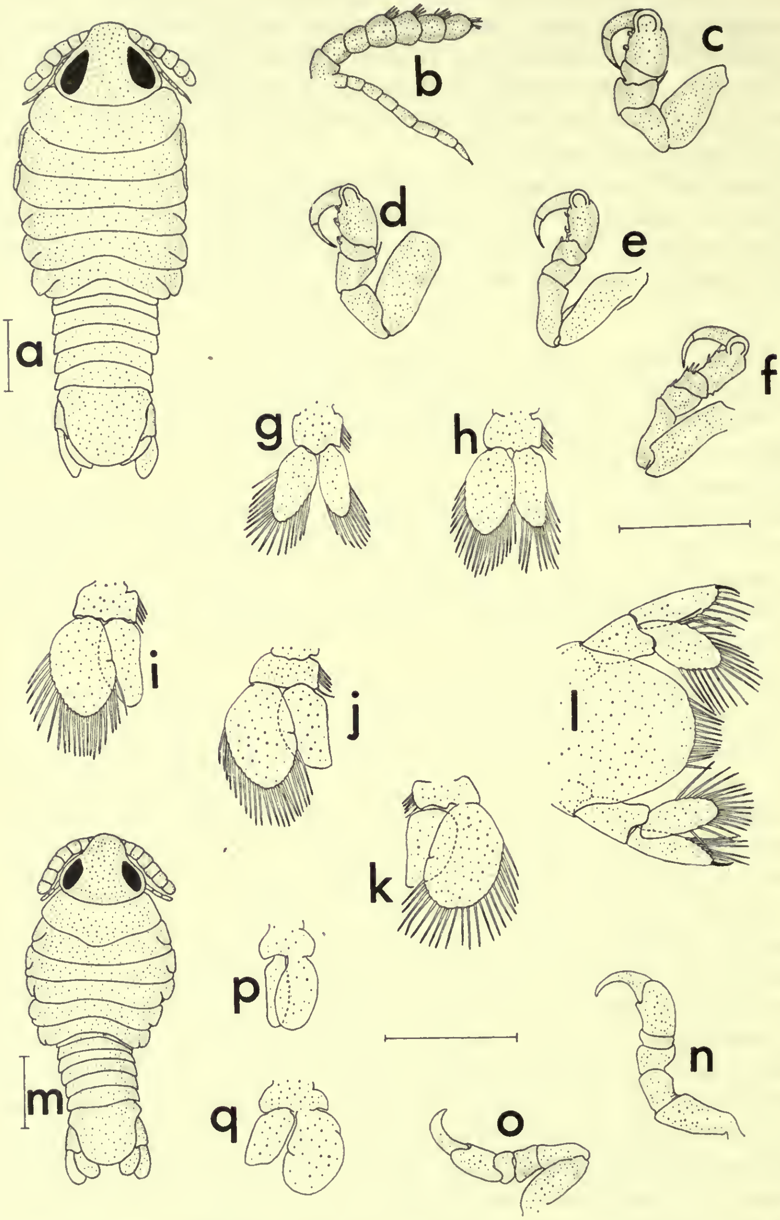

FIG. 3. *Lironeca africana* sp. nov. a–l, second marsupial stage: a, body entire, dorsal; b, antennae 1 & 2; c, peraeopod 1, left; d, peraeopod, 3, left; e, peraeopod 5, left; f, peraeopod 6, left; g, pleopod 1, left; h, pleopod 2, left; i, pleopod 3, left; j, pleopod 4, left; k, pleopod 5, left; l, uropod & telson entire. m–q, first marsupial stage; m, body entire, dorsal; n, peraeopod 1, left; o, peraeopod 6, left; p, pleopod 1, left; q, pleopod 2, left; bar scale 0·5 mm.

set of coupling spines; exact number of marginal setae on the pleopods is somewhat variable; uropods (Fig. 3l) with long plumose setae, the exopod bearing a single large curved spine at the distal tip.

REMARKS. As might be expected in a group which shows marked polymorphism, there are some small morphological variations in the paratype material. It is important to appreciate this variability when attempting to identify material such as this, and the lack of such appreciation has undoubtedly been partly responsible for the very large number of species which have been described in the past.

The shape of the telson in females shows some variation from that of the holotype, and may be broad, almost rectangular, with a stright posterior margin. The peraeon in one of the specimens is asymmetrical, and there are some differences in proportional lengths of the peraeon tergites. The first tergite of the peraeon is not always markedly longer than tergites 2–6, but in all specimens the last tergite is reduced in length. In the holotype the peraeopods are all approximately the same length, while in the largest female paratype there is a small increase in the length of the peraeopods from 1–7, reflected in the size of the ischial segment, the length of the other segments remaining unchanged. In the males it is important to note that the body may show signs of asymmetry, and there is a wide range of body size, some specimens being very small.

The parasites were all taken from the mouth cavities of the cichlid fishes *Lamprologus elongatus* Boulenger and *Lamprologus pleurostigma* Boulenger. The fishes examined were part of an extensive collection taken from Lake Tanganyika and deposited in the collections of the British Museum (Natural History). The female parasite was attached to the tongue of the fish, with the long dactylae of the peraeopods embedded deeply into the tissues of the host. The isopod was situated with its head innermost, the posterior end of the body being about level with the angle of the host's jaw. Despite the large size of the parasite the fish was still able to close its mouth fully. The male parasite was found in close association with the female, attached either to the side of the mouth or the inside of the gill chamber. Only one male was found in the presence of each female.

Lironeca africana is readily distinguished from other freshwater African species by the general outline of the body and the contour of the posterior margin of peraeon tergite 7. *Lironeca expansus* is broadly elliptical in outline and the posterior margin of tergite 7 has a deeply concave contour, with the pleon strongly immersed into the peraeon. The head is also deeply set into the peraeon and projects very little, if any, beyond the general outline of the body. *Lironeca tanganyikae* has an oval outline, somewhat similar to *africana*, but the margin of tergite 7 is broadly convex with the median part straight. The pleon is only moderately immersed into the peraeon. In *Lironeca africana* the body is more elongate, the convex posterior margin of tergite 7 is an even curve, and the pleon is but weakly immersed. The characters mentioned above refer to the mature female stage.

The isopods belonging to the family Cymothoidae are protandrous hermaphrodites and it has been usual practice to base the description of a new species on the adult female stage. In the case of *Lironeca enigmatica*, described by Fryer from Lake

Tanganyika, the fully mature female was not available and the type series consists of a number of young male specimens varying both in size and in degree of development. The presence of setae on the pleopods and uropods indicates that these isopods were capable of free swimming, and it still remains to be shown whether or not the adult parasite is to be associated with the same species of fishes from which the *enigmatica* material was taken. Bearing this in mind, and appreciating the marked transformation which takes place when the parasite takes up permanent residence with the host, it could prove particularly difficult to establish the true identity of the adult female. To separate *enigmatica* and *africana* it is pointless to look at the male or female of the latter as they are no longer free swimming, and have lost all traces of pleopodal and uropodal setae. It only remains to compare *enigmatica* with the late marsupial stage of *africana*, which does have a full setal compliment in preparation for its early free swimming existence. These can easily be distinguished on the basis of the number of spines and hooks on the peraeopods and also the shape of the telson.

A close investigation of the characters possessed by the late marsupial juvenile stage of cymothoids may eventually provide an answer to some of the many problems which face the taxonomist working with this group. At the present time there are many genera which are separated on quite unreliable features and, as Fryer points out, it is quite possible to refer a given specimen to any of a number of genera. This has led to some genera receiving a large number of species, *Lironeca* being a good example, while others have remained monotypic.

ORIGIN OF LAKE TANGANYIKA ISOPOD FAUNA

The discovery of this parasite in association with cichlid fishes of the genus *Lamprologus* revives the question of the origin of the Lake Tanganyika isopod fauna. The cymothoids found in the Lake have very obvious affinities with marine members of the group, with which they no doubt share a common marine ancestral group. The problem is to establish when the isopods made their entry into the Lake and acquired freshwater status. Three main possibilities exist, although the first of these to be outlined can be said to have little support from present knowledge of the geology and biology of the Lakes region of eastern Africa. In a book *'The Tanganyika Problem'* published in 1903, Moore discussed the apparent affinities of the Lake fauna, with special reference to the molluscan groups, and arrived at the conclusion that the fauna had evolved from an ancient Jurassic marine stock which became isolated when the Lake was cut off from the sea. If the fauna originated in in this way, the transition of the animals to a freshwater existence would have occurred within the Lake, and the parasites could have made the change in association with their fish hosts. But, as has been noted above this theory of the origin of the Lake fauna and of the Lake itself has now been largely abandoned.

From the evidence of the present distribution of the freshwater parasites it seems most likely that the isopods entered the Lake from a connection with the Congo river system. Lake Tanganyika is the only one of the Lakes in eastern Africa which is known to have the parasites, and the Congo River system is the only one of the rivers known to have a freshwater cymothoid fauna. If the isopods entered the

Lake region at a time before the isolation of Lake Tanganyika itself, one would expect to find them in some of the other bodies of freshwater, but this is not the case. It is now generally accepted that Tanganyika was formed sometime during the Pleistocene, but the question remains whether the isopods reached the Lake soon after its isolation, or whether they moved in from the Congo through some river connection in comparatively recent times. The evidence, limited as it is, tends to support the former possibility.

The two species of parasite found in the Lake for which a final host is known, *tanganyikae* and *africana*, are both associated with cichlid fishes, and show strict host specificity. This in itself suggests a long association, and the cichlid fishes represent a rich endemic element in the Tanganyika fauna. The third cymothoid known from the Lake, *enigmatica*, was taken from the clupeids *Stolonothrissa* and *Limnothrissa*, but these isopods were still juvenile and capable of free swimming, and the identity of their final host has not yet been established. Fryer (1968) points out that these clupeids have marine ancestors and the parasite may have made the transition to freshwater with the fish, and further suggests that this could represent a separate invasion of the Lake by the isopods. This cannot be disproved, but it is worth noting that the fishes in question are pelagic species which aggregate in large shoals, and are sufficiently abundant to be commercially exploited (Coulter 1970). Fish which move freely about the Lake and undergo marked diurnal migration would provide ideal dispersal for the juvenile free living stages of a parasite, and it seems quite probable that they are acting only as temporary intermediate hosts for the isopods. The fish are preyed upon by numerous carnivorous fish species, including some cichlids, and this may be the step by which the parasite reaches its final host. The speculation will remain until the adult *enigmatica* has been found, but if the view outlined above is found to be true, and the adult parasite is associated with a cichlid fish, it will be less of an enigma than the name was intended to suggest.

The cymothoid, *expansus*, found widely in the waters of the Congo, is without doubt a very close ally of the Tanganyika species. It too would seem to be host specific, on *Eugnathichthys eetweldii*, as I can find no record of it having been taken from any other fish, not even from a closely related species of the same citharinid fish genus which is also common in the Congo river.

The obvious affinities of the freshwater cymothoids in Africa one with another, and their very restricted distribution, indicates an entry into Lake Tanganyika from the Congo river system. The strict host specificity of the parasites and the endemicity of the host fishes points to an early invasion of the Lake rather than an entry in more recent times. However, the nature of this brief summary must remain speculative until a great deal more is known of the isopods of the African continent.

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EUNICE MANIHINE SP. NOV. (POLYCHAETA: EUNICIDAE), A MEMBER OF THE FLAVUS-BIDENTATE GROUP FROM THE WESTERN EQUATORIAL INDIAN OCEAN

By M. R. LONGBOTTOM†

SYNOPSIS

A new species of the genus *Eunice* Cuvier, 1817, is described from 421 m depth in the western equatorial Indian Ocean. The characteristic features are: yellow, bidentate acicular setae, up to 4 per parapodium; up to 6 acicula per parapodium; branchiae, with few filaments, present from setiger 8 to 43; smooth occipital tentacles, the median reaching to setiger 24.

INTRODUCTION

The few surveys of polychaetes carried out in the western equatorial Indian Ocean have been restricted to intertidal and shallow-water habitats, rarely exceeding 50 m depth (Crossland, 1904), and little is known of the fauna of the rough bottoms at greater depths. During the Royal Society Indian Ocean Deep Slope Fishing Expedition (January/February, 1969), vertical bottom lines were fished from the FRV *Manihine* around the islands and banks in this region of the Indian Ocean (Forster *et al.*, 1970). One of these lines foul-hooked a piece of coral debris at 421 m, in which was a eunicid worm; further examination showed this to be an undescribed species of *Eunice*.

The genus *Eunice* Cuvier, 1817, consists of a large number of valid species (approximately 140) for which the common specific characters and their variations are discussed in a recent review (Fauchald, 1970). Briefly, these are the form and colour of the acicular setae (subacicular hooks), the distribution and form of the branchiae, and the length and form of the occipital tentacles. Combinations of these and, frequently, other characters serve to distinguish the species, only rarely is one of these major characters alone sufficient. Major divisions, based on the form and colour of the acicular setae, were suggested by Hartman (1944), resulting in four groups of those species for which the relevant details were known. This system has been expanded to include a greater number of valid species, and, based on the distribution of the branchiae, five subdivisions have been proposed for each of seven groups (Fauchald, 1970).

DESCRIPTION

The single specimen of *Eunice manihine* sp. nov. consists of 127 setigers and is approximately 75 mm long (9 mm from the tip of the palps to the posterior edge of the tenth setiger on the dorsal side, following Fauchald, 1970) and 5 mm wide. The specimen is cylindrical in the anterior region, and becomes flattened towards the posterior.

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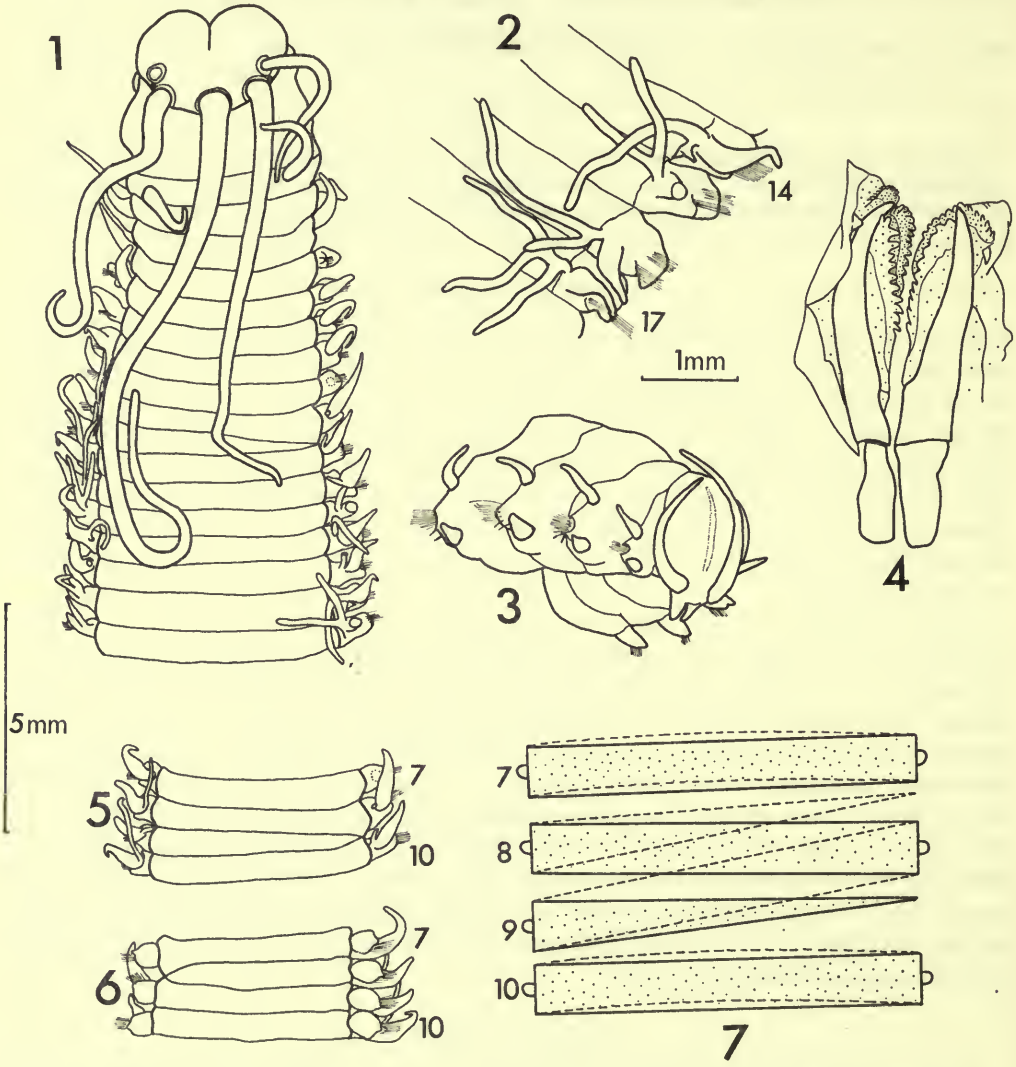
† Dr. Longbottom died August 6, 1971

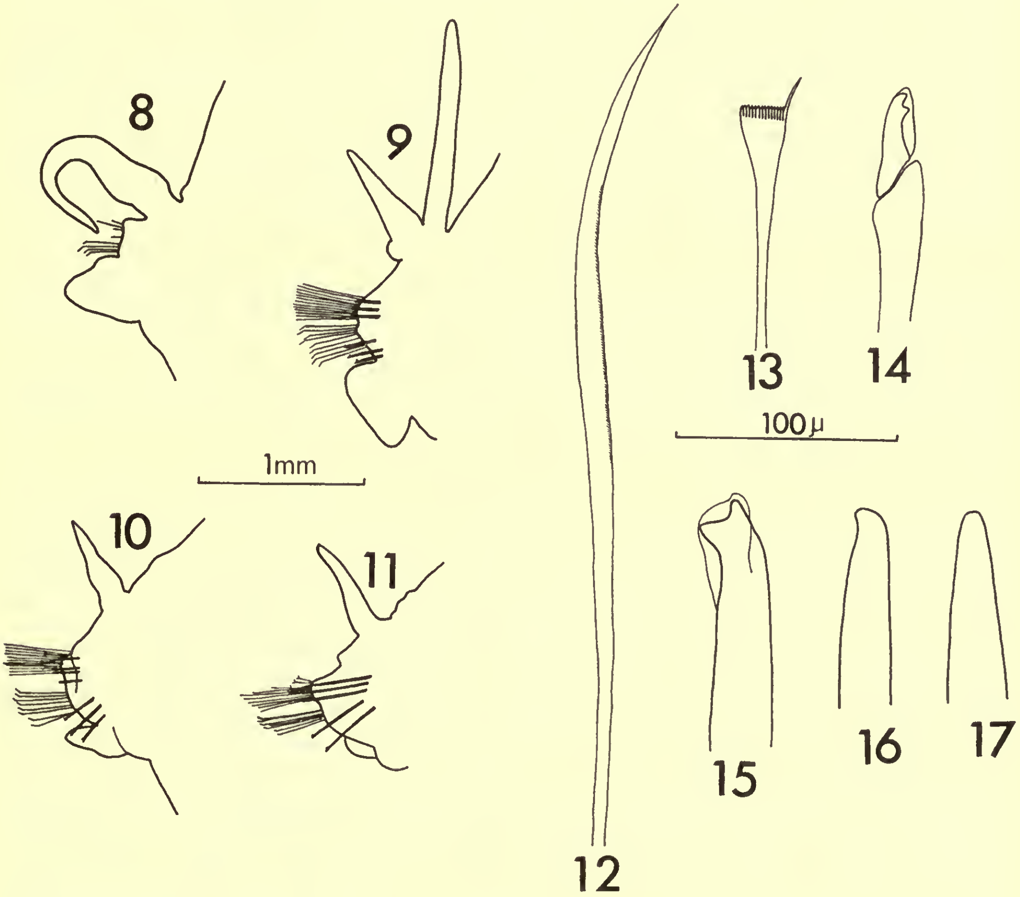
The anterior margin of the prostomium is distinctly notched between the palps (Fig. 1). The length of the prostomium is slightly greater than half the breadth. The prostomium bears a pair of eyes posterior to the gap between the bases of the



FIGS 1–7. *Eunice manihine*. 1. Anterior end, dorsal view (left outer occipital tentacle missing). 2. Setigers 14–17 right side, dorsal view. 3. Posterior end, left lateral and slightly ventral view. 4. Maxillary plates, dorsal view. 5. Setigers 7–10, dorsal view. 6. Setigers 7–10, ventral view. 7. Setigers 7–10, diagrammatic representation, dorsal side firm lines.

inner and outer occipital tentacles (Fig. 1). Five smooth and very long, slender tentacles are present; the unpaired median tentacle reaching back to setiger 24, the inner lateral tentacles reaching setiger 12 and the outer laterals setiger 3. The first peristomial segment is two thirds the length of the prostomium; the second peristomial segment is half the length of the first and the same length as the first setiger. The peristomial cirri are smooth and reach just beyond the posterior border of the prostomium.

The maxillae are well developed (Fig. 4); maxilla I is falcate; maxilla II has 12 teeth left and 11 teeth right; maxilla III has 12 teeth left; left maxilla IV has 11 teeth and the combined right maxillae III+IV have 13 teeth; each maxilla V has 1 tooth.



Figs 8–17. *Eunice manihine.* 8–11. Parapodia from right side, anterior view. 8. Setiger 4. 9. Setiger 34. 10. Setiger 60. 11. Setiger 90. 12. Capillary seta from setiger 90. 13. Comb seta from setiger 90. 14. Falcigerous seta from setiger 34. 15. Acicular seta (subacicular hook) from setiger 34. 16. Aciculum from setiger 34. 17. Aciculum from setiger 60.

Branchiae are present only in the anterior third of the specimen: from setiger 8 to setiger 43. The branchiae consist of a single filament anteriorly (Fig. 1) with a maximum of 3 filaments between setigers 17 and 22 (Fig. 2), decreasing posteriorly to a single filament. The filaments are thinner than the dorsal cirri in the branchial region (Fig. 2). The dorsal cirri are smooth, anteriorly with a stout base and elongated tip (Fig. 8), posteriorly digitiform (Figs 3 & 11). The ventral cirri are subulate (Figs 3, 6, 8–11). Two pairs of anal cirri are present (Fig. 3), the dorsal pair long and the ventral pair very short.

In the majority of the parapodia there are, superiorly, between 10–18 long, slightly limbate, capillary setae with weak striations (Fig. 12), and, towards the posterior, 5–9 comb setae with 14–16 teeth, usually with the outer tooth on one side appreciably longer (Fig. 13). Inferiorly, there are 7–9 falcigerous setae, the blades of which are strongly bidentate, with a rounded hood projecting just beyond the tip (Fig. 14). The head of the shaft is slightly enlarged. The acicula are yellow with slightly curved tips (Figs 16 & 17). An average of 3 or 4 are present in each parapodium, with up to 6 in the middle setigers, decreasing to 2 posteriorly. The inferiorly situated acicular setae (subacicular hooks) are first present, singly, from setiger 27/28, with 3–4 per parapodium from setiger 31 throughout the remainder of the setigers. The acicular setae are yellow, bidentate, and hooded (Fig. 15).

DISTRIBUTION

E. manihine is known from one specimen found in a piece of coral debris foul-hooked on a bottom fishing line from 421 m depth, south of Menai Is, Cosmoledo (10° S, 47° E), in the western equatorial Indian Ocean.

The type specimen (Ref. no. ZB 1971·1) which is preserved in alcohol has been deposited in the British Museum (Natural History).

DISCUSSION

No single character is sufficient by itself to distinguish *E. manihine* from other members of the genus; the separation is based on a combination of the following characters: yellow, bidentate, acicular setae; branchiae of few filaments restricted to the anterior third of the body; very long, smooth, occipital tentacles; the form of the maxillary plates; and the large number of acicula per parapodium. The first two characters are common to many species of *Eunice* and are discussed in greater detail below. References in the literature to occipital tentacles reaching to near or beyond setiger 20 are uncommon: *E. antillensis* has been recorded with the median tentacle to setiger 20 (Ehlers, 1887), *E. auriculata* to setiger 18 (Treadwell, 1901), *E. palauensis* to setiger 18 (Okuda, 1937), and *E. tibiana* (Pourtalès, 1863) to setiger 22 (Izuka, 1912). Of these species only *E. antillensis* is a member of the flavus-bidentate group. However, the degree of variation within a species is not known, and to some extent is dependent upon the state of preservation. This also applies to the form of the tentacles, whether they are wrinkled or clearly articulated. The presence of as many as 6 acicula per parapodium is very unusual, contrasting with the more normal number of 1–3 for species of *Eunice*. The number of teeth on the maxillary plate is also greater than is usually found in the genus.

Adoption of the system of subdivision proposed by Hartman (1944) and Fauchald (1970) enables comparisons to be made more easily within this large genus. *E. manihine*, in possessing yellow, bidentate acicular setae, clearly belongs to the flavus-bidentate (A) group of Hartman (1944), and from the distribution of the branchiae (commencing before setiger 10 and not present after setiger 100), to subdivision 1 of Fauchald (1970). As the numbers of setigers may vary in worms of different sizes, it is suggested that the definition of this subdivision should be expanded to place the emphasis on the branchiae being present in the anterior third of the body rather than within a definite number of setigers irrespective of the size of the worm.

Fourteen species are listed by Fauchald (1970) within this group A1 to which should be added *E. semisegregata* Fauchald, 1970, and from which should be removed *E. benedicti* (Verrill, 1885)—a synonym of *E. pennata* (Müller, 1776) (see Pettibone, 1963)—and *E. norvegica* (Linnaeus, 1767). The latter, in having black bidentate acicular setae, and branchiae present from setiger 3 to within a few setigers of the anus (Pettibone, 1963), should be placed in the fuscus-bidentate (B) group, subdivision 2. All the previously described species in the A1 grouping have the branchiae commencing on setiger 3. Fauchald (1970) has suggested that this is a constant feature within a species, though small variations have been recorded, as for example in *E. pennata* (Pettibone, 1963). Thus, *E. manihine* is the sole member of the flavus-bidentate group in which the branchiae commence before setiger 10, but after setiger 6. Apart from *E. manihine*, only two species—*E. megabranchia* Fauchald, 1970 and *E. validobranchiata* Monro, 1937— in the A1 group have smooth occipital tentacles, the remainder have articulated or moniliform tentacles. *E. megabranchia* (from 894 m depth in the Gulf of California) and *E. validobranchiata* (from 1046 m depth off the South Arabian coast) differ only in the length and shape of the guards of the falcigerous setae and the form of the ventral cirri; the other characters are very similar and for comparison with *E. manihine* may be considered identical. Specimens of these two species of a similar size to the *E. manihine* specimen differ in having branchiae with large numbers of filaments (up to 45) commencing on setiger 3, appreciably shorter occipital tentacles, fewer acicular setae per parapodium and fewer teeth on the maxillary plates.

Of the eunicid polychaetes reported from East Africa (Crossland, 1904), only one species of the flavus-bidentate group was reported—*E. tubifex* Crossland, 1904. This belongs to Fauchald's subdivision 4, in which branchiae are present from after setiger 10 to the posterior.

The type specimen of *E. manihine* shows an abnormality in the segmentation of setigers 8 and 9 (Figs 5 & 6), resulting in a short spiral (Fig. 7) similar to the form Buchanan (1893) found in specimens of *Lumbriconereis impatiens* (=*Lumbrinereis tetraura*). It was not possible to examine the internal anatomy of the single specimen available.

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ORIGINAL DESCRIPTION OF THE GANGETIC DOLPHNI, *PLATANISTA GANGETICA*, ATTRIBUTED TO WILLIAM ROXBURGH

By G. PILLERI

IN cetological literature the original description of the Gangetic dolphin is usually attributed to Heinrich Julius Lebeck. In the third volume of "Neue Schriften der Gesellschaft Naturforschender Freunde zu Berlin" that appeared in 1801, this author published a short paper entitled "Delphinus gangeticus beschrieben von Herrn Heinrich Julius Lebeck zu Trankenbar". "Trankenbar" obviously corresponds to the locality "Tranquebar" in southeast Madras.

In the same year, 1801, Volume 7 of "Asiatick Researches" was published in Calcutta and contained a paper of William Roxburgh entitled "An Account of a new Species of Delphinus, an Inhabitant of the Ganges".

It is, therefore, virtually certain that the two descriptions of the Gangetic dolphin were published in the same year, but the reviews contain no definite indication as to which of the two appeared first.

Roxburgh's paper was republished in 1803 by Maiden and Wilson of London in a second edition of "Asiatick Researches, printed verbatim from the Calcutta edition".

In recent reports (e.g. Hershkovitz 1966), data taken from literature on *Platanista gangetica* are frequently referred back to the paper published by Roxburgh in 1803, the date of publication of the London edition.

When G. Cuvier (1823) changed the designation of the genus *Delphinus* to *Platanista*, he claimed priority for Lebeck. E. Home (1818), on the other hand, in his paper on the morphology of the teeth of the Gangetic dolphin, referred to Roxburgh as the original author. M. F. Cuvier (1836) who, in nearly all other respects, based his work on the account of his brother (G. Cuvier 1823), expressed a doubt as to whom to attribute the original work. Referring to the paper of Home, he added a footnote at the bottom of page 252 that reads as follows: "T.VII, p. 170, pl. III (édit. de Londres, 1803, in-4°). M. Home dans sa description des dents de ce dauphin, cite le mémoire de Roxburgh comme ayant paru en 1721 dans les mémoires de la societé de Calcutta. Ces mémoires paraissaient-ils alors? L'édition de Londres est une copie de celle de Calcutta". "1721" is obviously a printing error.

When John Anderson (1833–1900) first took up his activities in India he was staying with his brother, a doctor and botanist, in the house built in the Botanical Gardens by Roxburgh. On page 418 of the monograph he published in 1878 on *Platanista* and *Orcaella*, Anderson mentioned that Roxburgh claimed to have published the first description of the Gangetic dolphin, but made no further comment on the fact.

A comparison of the two papers of Lebeck and Roxburgh reveals a striking similitude in the text, both as regards their presentation and the zoological data they contain. Here, I should like to give a brief summary of the lives of the two authors.

William Roxburgh. Born at Underwood, Craigie, Ayrshire, on June 3rd, 1751, William Roxburgh became a distinguished botanist. He studied in Edinburgh under John Cope and it was Cope who procured him an engagement as assistant surgeon on a ship of the East Indian Company. After several voyages to the tropics, he was granted a degree of Doctor of Medicine in Edinburgh and from 1776–1778 worked in the General Hospital in Madras. In 1780, he became full surgeon and a year later took up a post at Cocanada, in the delta of the Godavery River, where he was mainly occupied with applied botany. It was during this period that he undertook his very extensive collection of plants and illustrations of the Indian flora. In 1793 he was appointed Superintendent of the Botanical Gardens of Calcutta but four years later he was forced to return to Scotland on account of ill health. He went back to Calcutta in 1799, but had to leave India again in 1805. His state of health continued to deteriorate and he sought recovery at the Cape and in St. Helena, but in vain. He finally returned to Scotland and died in Edinburgh on February 15th, 1815.

The numerous and very comprehensive studies undertaken by William Roxburgh, some of which were published after his death by Wallich, constitute a valuable contribution to the knowledge of the Indian, and more particularly, of the Bengalese flora (see Lee 1897). He also compiled reports on water insects, silk worms and land winds. The work on the Gangetic dolphin (1801) falls in a period of Roxburgh's life already overshadowed by the outbreak of his serious illness.

Heinrich Julius Lebeck. In spite of extensive investigations in a large number of libraries at home and abroad, I have not been able to uncover any biographical details on the life of Lebeck. The only reference I found to his life was contained in the book of G. Cuvier (1823) who mentioned that he was a "Danish missionary in Tranquebar". However, this piece of information is obviously inaccurate as Gosch (1875), in his book on early Danish zoological literature, describes Lebeck as a German missionary. Furthermore, the biographical lexicon in the royal library in Copenhagen contains no mention of Lebeck.

The descriptions of Lebeck and Roxburgh

It should be pointed out that Roxburgh stresses the discovery of a new species in the title of his work, "An Account of a *New Species* of Delphinus", and Lebeck does not. Both descriptions refer to a male specimen from the Calcutta region of exactly the same size (!). What is even more significant is that not only were the measurements quoted in the two papers identical, but in Lebeck's paper British linear measurements and British avoirdupois weights were used. If the original contribution had been German one would logically expect the author to have employed German units. The two reports start with Linnaeus and state that the Gangetic dolphin is a fifth, new species to be added to the four species of dolphins described by Linnaeus. The head, teeth, tongue, eyes, external auditory passages, fins and genitals are described in the same order. Both authors found nematodes and plant seeds in the stomach. Both mention the thickness and strawyellow colouring of the blubber as well as the fact that dolphins oils are used for medicinal purposes by the natives.

Not only is the order in which the organs are described in the diagnosis of the species identical, but also, whole sentences are repeated word for word.

A comparison of the texts leads to the conclusion that one of the two authors was acquainted with the text of the other before he published his own work. It is also significant that Lebeck mentions a "zweiten mir gezeigten Rüssel eines solchen Tieres"[1] (page 282). I presume that this rostrum could only have been shown to him within the natural science circles of Calcutta, the town where research on the Gangetic dolphin originated with the collections and observations of Roxburgh, Blyth and, later, John Anderson.

Here it is worth while noting that in the British Museum (Natural History) a cast of rostrum Nr. 1884.5.3.1, River Ganges, is exhibited with the label: "the original specimen now in the Museum of the Royal College of Surgeons[2] was described and figured by Dr. Roxburgh—it exhibits in great perfection the characters of the teeth in aged animals, which are quite different from these of the young". It is tempting to conclude that this is the specimen previously shown to Lebeck.

It is not certain that the "Neue Schriften der Gesellschaft Naturforschender Freunde zu Berlin" was also available in Calcutta in 1801. Certainly no copy of this journal is included in the Indian Museum library to-day. "Asiatick Researches", on the other hand, must have been easily accessible to Lebeck who was living in India, or had lived in India, at about that time.

There is no doubt that Roxburgh made very thorough observations of the Hughly river dolphins, since his house, as Anderson (1878) explained, resembled the bridge of a ship and commanded an extensive view of the Hughly river. Gangetic dolphins still swim in this river to-day as they did in the past. Roxburgh was also interested in hydrobiological problems (water insects) which is further proof of his familiarity with Indian rivers. He was considered an expert responsible for many botanical discoveries and descriptions of Indian plants.

Although he was predominantly a botanist Roxburgh did have the preliminary training as a surgeon so, like Anderson, he would have had the basic knowledge of anatomy that would have made him competent to deal with a dolphin. It is inconceivable to me that a man of his experience would need to copy a report of Lebeck. The contrary is much more plausible. Therefore, I am of the opinion that William Roxburgh, and not H. J. Lebeck, was the first author to describe this interesting species of cetacean, and suggest that in the future publications on the Gangetic dolphin, the species should be referred to as *Platanista gangetica* (Roxburgh 1801).

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[1] "the second rostrum I was shown of such an animal".

[2] The specimen was destroyed by enemy action during the second world war.

the Keeper of Zoology Dr. J. P. Harding of the British Museum (Nat. Hist.), London, who allowed me admittance to the osteological collections. I also wish to extend my thanks to Dr. M. Gihr, Dr. C. Kraus, Prof. B. Hörning in Berne, and Dr. U. Møhl, Zoological Museum Copenhagen, for their help in the bibliographical research and to Mrs. Diane M. von Nordheim, Geneva, for the English translation. The work was sponsored by the Swiss National Fund for the Promotion of Scientific Researches.

SUMMARY

The attribution of the original description of *Platanista gangetica* to Lebeck is contested. It is first established that the descriptions of Lebeck and Roxburgh were published in the same year, i.e. in 1801, and the reasons for concluding that the description of Lebeck was copied from that of Roxburgh are set out. It is suggested that Roxburgh be considered the author of the original description of the Gangetic dolphin.

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A NEW GENUS AND SPECIES OF SUDAN LEECH FORMERLY CONFUSED WITH *LIMNATIS NILOTICA* (HIRUDINIDAE S.L.: HIRUDINEA)

By L. R. RICHARDSON

SYNOPSIS

A new genus is based on a leech from Zalingei Swamp, Sudan. It has 3 pairs of narrow broken lines on the dorsum, somitally repetitive supramarginal maculations, and a marginal light stripe; but there are 16 complete 5-annulate somites, the posterior sucker is of moderate size, ejaculatory bulbs are present, and there are linear somital sense organs on the dorsal aspect of the posterior somites. A closely similar leech is recorded also from the Nile, near Fashoda.

INTRODUCTION

Leeches with salivary gland papillae on the jaws have been found in all regions, essentially between 35° North and South. Of these, only leeches in the Mexican genus *Limnobdella* Blanchard 1893, the Australian genus *Quantenobdella* Richardson 1969, and the present leech have 16 complete 5-annulate somites, all others (Soos, 1969) have 15 such somites, including the leeches in the Ethiopian genus *Limnatis* Moquin-Tandon 1826 based on *L. nilotica* (Savigny 1822). The genus *Limnobdella* (v. Richardson, 1969 : 106, '*Potamobdella*') has a macrobdelloid pharynx with some muscular ridges ending independently between the jaws on the entrance to the pharynx, multiple small testes in each somite, the epididymis formed on both limbs of a simple primary loop on the anterior region of the male paired ducts, no ejaculatory bulbs, the median regions bimyomeric and the female median region with an acaecate vagina and vaginal duct. The genus *Quantenobdella* described as lacking salivary gland papillae and having an hirudoid pharynx, is now found to have minute papillae and the pharynx smooth internally. *Quantenobdella* has simple saccular testes; the anterior region of the male paired duct lacks a loop and the epididymis is entirely posterior to the ejaculatory bulb, the two being linear in relationship; the median regions are bimyomeric and the female median region has a caecate vagina and a vaginal duct.

In the present leech, the pharynx is hirudoid; the testes are simple, saccular; the anterior region of the male paired duct forms a simple primary loop with the epididymis on the initial limb and an ejaculatory bulb on the terminal limb in a subparallel relationship; the median regions of the reproductive systems are as in *Limnobdella*.

These differences warrant the provision of a separate and new genus for the leeches from the Sudan. It has been shown (Richardson, 1969) that the content of the former family Hirudinidae based on the genus *Hirudo* was unacceptably heterogenous. Although separate families were provided then for Australian, Nearctic and Neotropical genera, the provision of a family for Oriental and Ethiopian leeches having an acaecate vagina, as in the present leech, must be postponed until the aquatic jawed sanguivores of these regions are more adequately known. For the time being, the new genus can be referred to the Hirudinidae s.l.

Moore (1939) identified leeches in single collections from the American Museum of Natural History, the United States National Museum, and the British Museum (Natural History), all as being *Limnatis nilotica.* He briefly referred to them as resembling this species in having the annulation in no way differing from published accounts and with small papillae, large caudal suckers, the morphology of the crop caeca and of the reproductive systems as in Moquin-Tandon (1846, pl. vi, *Haemopis sanguisuga*) and Dequal (1912). The characteristics as taken from these authors are: a small anterior pair and a larger posterior pair of caeca on each compartment of the crop; the epididymis formed on both limbs of a simple primary loop on the anterior region of the male paired duct which lacks ejaculatory bulbs; the two ejaculatory ducts enter independently into the atrium (Moore, 1939, Fig. 58) and the vagina acaecate with a vaginal duct of the same length as the vagina. The vaginal duct is shown as short by Dequal (1912, Fig. 13) and the vagina possibly caecate; but there is definitely no duct according to Moquin-Tandon (1846, pl. vi, Figs 15, 17). Moore recorded from the specimens before him, the presence of only 45 to 60 teeth, a pattern of 3 pairs of continuous or broken dark dorsal 'lines', yellow marginal stripes and the venter immaculate as in 'typical North African' examples of this species.

Moore's material in the British Museum (Natural History) was collected in 1925 and came from Zalingei Swamp, former British Sudan. Specimens from this collection and another from the Nile near Fashoda, 1907, were loaned to Keegan *et al.* (1969) who figure without other description a leech from one of these collections, under the name of *Limnatis nilotica.* (The external features, Figs 7 A & B, 8 A & B; the jaw, Figs 8 C & D, and reproductive system, Fig. 8 E.)

The reproductive system as shown in Keegan *et al.* differs from the illustration in Moore (1939, Fig. 58) of the system in a specimen in the U.S. National Museum collection No. 5501, from between Abyssinia and British East Africa, in that Keegan *et al.* show small ejaculatory bulbs embracing the epididymi and the two ejaculatory ducts joining to form a distinct common duct leading to the atrium. No such common duct has been known in jawed sanguivorous or macrophagous leeches, the two ducts always entering the atrium independently.

Re-examination of specimens from the 1925 Zalingei Swamp and 1907 Fashoda collections confirm the basic pattern as described by Moore and shown in Keegan *et al.* The jaws carry minute teeth and papillae. Three dissected leeches show anterior and posterior paired caeca on the crop compartments but differ from Keegan *et al.* in having the ejaculatory ducts entering independently into the atrium, as in Moore (1939). They further agree with Moore in having a single primary loop on the anterior region of the male paired duct but differ by having the epididymis on the initial limb of the loop subparallel to the bulb on the terminal limb, as in Keegan *et al.* They differ again from Moore in having linear somital sense organs on the dorsum of the posterior part of the body, as in most species of *Limnatis* (i.e. excepting *paluda* and possibly *nilotica*).

In having 16 complete 5-annulate somites, the specimens differ from the genus *Limnatis* as defined by Moore (1927) and Soos (1969). As I have shown previously, if we attempt to follow Moore (1927 et seq.) and admit such a difference into a single genus, the generic entity fails on other grounds (Richardson, 1969, 1970). There is no established genus suitable for them. Accordingly I provide a new genus as below.

DESCRIPTION

Aliolimnatis gen. nov.

Hirudinidae s.l. with a monostichodont condition; 16 complete 5-annulate somites (*ix* to *xxiv*); *xxv*, 4-annulate; somital sense organs, large and obvious on the dorsum, circular anteriorly, mostly linear and oblique posteriorly; jaws, moderate in size; teeth, minute, about 80; salivary gland papillae on the jaws; dorsal salivary glands, compact, a single mass without obvious columns of aggregated ducts; radial muscles, a distinct extrinsic system in *viii* and *ix*; pharynx and associated structures, hirudoid; mouth and lumen of pharynx, narrow, the lumen tubular; pharynx with six internal muscular ridges as dorsomedian and ventrolateral pairs, each pair joining to enter a jaw, none ending independently between the jaws; pharynx terminating posteriorly in *ix*; crop compartments in *x* to *xviii* each with an anterior small and posterior larger pairs of caeca, the posterior pair in *xix* forming the postcaeca extending to *xxvi*; intestine, simple tubular, joining terminally to the rectum; genital pores in *xi* and *xii* b_5/b_6; testes, normally 10 pairs; anterior region of male paired duct folded as a simple primary vertical loop, the epididymis on the initial limb posterior to the ejaculatory bulb on the terminal limb, the relationship subparallel; median regions, bimyomeric, mesomorphic; penis sheath reflected anteriorly; oviducts, short, of the length of the ovaries; atrium, thick-walled, large; common oviduct, thick-walled, longer than the oviducts, continuous with the acaecate vagina; vaginal duct, short.

Size, (?) medium. Pattern, longitudinal interrupted narrow dark bands, marginal contrast stripes.

Aquatic. Sanguivorous. Ethiopian Region.

The name *Aliolimnatis* is derived from *alius* another, and *limnatis* of the marshes. The gender is feminine.

TYPE SPECIES: *Aliolimnatis diversa* sp. nov.

Aliolimnatis diversa sp. nov.

Fig. 1 A–F

HOLOTYPE: B.M.(N.H.) Reg. No. 1970 3 1

SCHIZOHOLOTYPE: B.M.(N.H.) Reg. No. 1970.3.2 right ventrolateral jaw (microslide).

PARATYPES: B.M.(N.H.) 1970.3.3 (18·0 mm long). 1970.3.4.

LOCALITY: Zalingei Swamp, Sudan. (Coll. Admiral Lynes.)

General form. *Holotype* (Fig. 1, E.) preserved in alcohol, rather strongly contracted with the annuli generally at least as high as long; short, heavy-bodied, depressed, the dorsum almost flat, the margins obtusely rounded, the venter flat, and the depth nearly uniform along the length of the body.

The anterior sucker broad, the aperture transverse; the velum proper contracted, thick margined and turned ventrally; the body widening gradually behind the sucker, at first subcircular in section, then widening more rapidly to the anterior end of the clitellum and from here to the post-nephridial region, the width uniform, the margins parallel, converging abruptly in the post-nephridial region to form the narrow base to the sucker. The posterior sucker is about half the maximum width of the body.

Total length, 22·0 mm; depth generally 3·0 mm; width at *iv/v*, 2·4 mm, at *vi/vii* 4·0, at *ix/x* 4·8; clitellum and testicular region, 6·0 mm wide; basis for sucker, 2·0 and diameter of sucker 3·0 mm.

Colour and pattern. (Fig. 1, A, B, C, E.) Preserved, faded; general background colour, faintly yellowish brown on the dorsum, paler on the immaculate venter which is separated by a pair of dark longitudinal bands from distinct pale cream marginal stripes. A dark patch across the posterior quarter of the dorsum of the sucker which is otherwise pale above and below.

Three pairs of weakly indicated maculated interrupted dark longitudinal lines form narrow bands on the dorsum, dividing it into a median stripe, a wide inner and two narrow outer pairs of longitudinal stripes, all of the background colour so that the dorsum is not brilliantly or colourfully striped, and the marginal stripes provide the only contrast colour other than the dark bands. The maculations which form the dark bands have the appearance of very large individual chromatophores.

The ocular arch is on the edge of the background colour, with the 5th pair of eyes in from this edge which becomes lateral to the supramarginal line in *viii* and immediately lateral to the line of marginal somital sense organs along the greater length of the body including *xxvi*, so defining above the cream marginal stripe continuous around the velum and back to *xxvi/xxvii*.

The inner and middle pairs of dark bands extend along the medial and lateral borders of the paramedian fields; the inner pair commencing in *viii* and extending to *xxvi* a2, define the median light stripe between these limits as filling the median field and including the paramedian sense organs. Between the ocular arch and *viii*, the median field and much of the interocular area are vaguely darker than the general colour elsewhere. The middle pair of narrow bands extend from in *vii* into *xxvi* (possibly also into *xxvii* for the dark patch on the sucker is divided as though into topographic equivalents of the inner and middle pair of bands). Between the inner and middle paired bands, the inner paired light stripe fills the greater part of the paramedian field, increasing in width as this field widens along the length of the body. The outer paired narrow dark bands are lateral in the intermediate field, extend from in *viii* back into *xxv* and between these limits define the middle paired stripes which include the intermediate sense organs and the greater part of the intermediate field.

The narrow outer paired stripes are lateral to the outer paired bands, defined laterally by the marginal stripe, and include the supramarginal sense organs, the supramarginal field and marginal sense organs along the greater length of the body.

In the middle half of the body, there are distinct small darker patches close to the lateral edge of the outer paired stripe. Each patch is restricted to an annulus. These occur with recognizable regularity on b_1 and b_5, in some somites on b_2 and b_5 and in a few somites on b_1 on only one side or the other. Such patches are present from *viii* to *xxvi*. The patches are spaced, nowhere give the appearance of a band, and form a distinct subsidiary pattern as in *Hirudinaria* and *Poecilobdella*.

The dark band separating the marginal stripe from the venter, extends along the line of the submarginal sense organs and briefly into the fields on either side.

ANNULATION. (Fig. 1, A, B, C.) Preserved, contracted. Intersomital and interannular furrows, very deep, equivalent; no obvious division of annuli into couplets or triplets; somital limits not indicated generally; annuli liberally divided by fine longitudinal lines into small rectangles. Somital sense organs are circular and difficult to detect on the venter, but obvious in large clear patches on the dorsum where all are circular in the anterior region but progressing posteriorly: the intermediates are elongate, linear and oblique to the long axis of the body; the supramarginals are linear along the long axis; then the paramedians are linear and oblique; and the supramarginals, linear and transverse. Linear somital sense organs occur back into *xxvi*; all are circular in *xxvii*. Sensillae are obvious with a central sensilla surrounded by others forming a rosette, the rosettes arranged as a row across the annulus, each rosette situated in a rectangle. Nephropores are obvious, minute, and situated close to the posterior border of a_1 and b_2 just laterally to the line of the intermediate sense organs.

The velum proper is broad with a thick incised margin. The velum includes the 1st to 3rd pairs of eyes; the first furrow *iv/v* does not reach the margin and the dorsolateral lobe of the margin of the sucker is not strongly defined anteriorly; *v*, 2-annulate above, a_1a_2 with the first eyes and first detectable paramedians $> a_3$, the furrow a_1a_2/a_3 reaching into the supramarginal fields with a_1a_2 briefly forming the lateral margin of the sucker which is completed by uniannulate *v* which also forms the ventral margin; *vi* is 3-annulate above, the 5th pair of eyes in a_2, $a_1 < a_2 > a_3$, a_1/a_2 ending in the supramarginal field and *vi* is 2-annulate below with $a_1a_2 > a_3$; *vii*, 3-annulate above and below, $a_1 < a_2 < a_3$; *viii*, 4-annulate with a_1 (=*vii* a_3) $> a_2 > b_5 = b_6$ and with the first pair of nephropores on a_1; *ix* to *xxiv* are all 5-annulate (total 16); *ix*, $b_1 = b_2 = a_2 < b_5 = b_6$; *x*, $b_1 = b_2 < a_2 = b_5 > b_6$, as also *xi*; due to contraction, the relative lengths of annuli are not assessable with confidence in *xii* to *xvii*; *xviii*, $b_1 = b_2 < a_2 < b_5 > b_6$, as also *xx* and *xxi*, so that b_5 may possibly be the longest annulus in typical 5-annulate somites of the middle nephric group; *xxiv*, $b_1 = b_2 < a_2 > b_5 = b_6$, and the last nephropores on b_2; *xxv*, 4-annulate above and below, $b_1 = b_2 < a_2 < a_3$; *xxvi*, 3-annulate above, $a_1 < a_2 > a_3$ but definitely 4-annulate below, a_1 being divided into $b_1 < b_2$ by a well-formed furrow which does not quite reach the margins of the body and is not to be seen from above; *xxvi* a_3 is the last annulus across the venter and is much

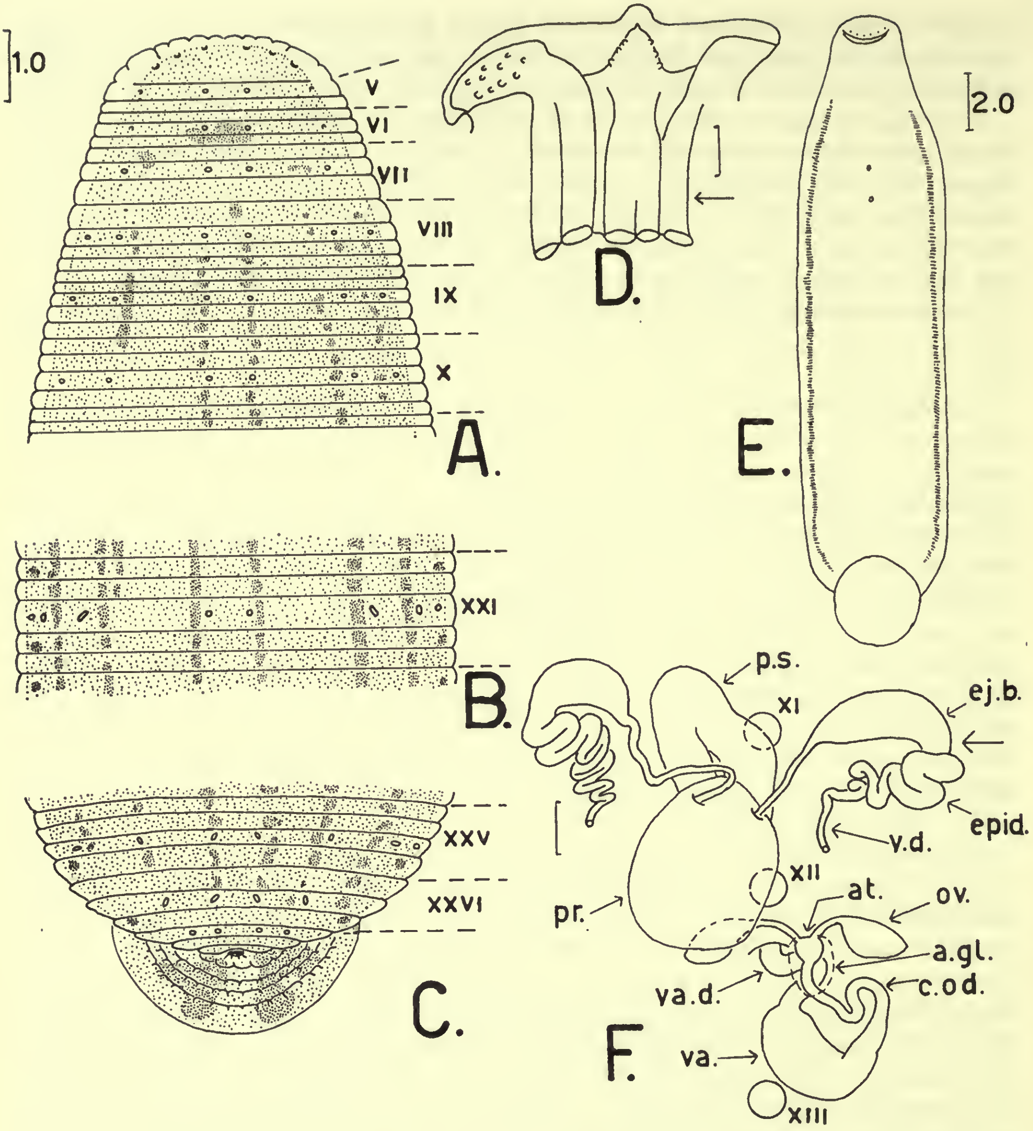

FIG. 1. *Aliolimnatis diversa* gen. et sp. nov. Dorsal annulation and pattern A. somites *i* to *x*, B. midnephric region, and C. somites *xxv* to *xxvii* and posterior sucker. D. Jaws, and internal muscular ridges of the pharynx opened along the midventral line (arrow marks mid-length of pharynx). E. Ventral aspect showing general form and submarginal bands. F. Anterior region of male paired ducts, male median region, and female reproductive system (arrow marks dorsal aspect of male primary loop). All figures from the type. Roman numerals indicate somites and somital ganglia. Somital ganglia represented at relative size. *A. gl.* albumin gland; *at.* atrium; *c. od.* common oviduct; *ej. b.* ejaculatory bulb; *epid.* epididymis; *ov.* ovary; *p.s.* penis sheath; *pr.* prostate; *va.* vagina; *va. d.* vaginal duct; *v.d.* vas deferens. Scales in mm, 0·5 mm unless otherwise indicated.

shortened; *xxvii*, incomplete 2-annulate with a brief accessory annulus. The anus is at the posterior border of *xxvii*.

Dorsum of the posterior sucker with 6 concentric furrows; some linear sense organs are detectable. The ventral face has some 20 primary muscle bands centrally, dividing to give in the order of 50 at the margin.

ALIMENTARY TRACT. (Fig. 1, D.) The jaws are monostichodont, compressed, the dorsomedially wider than high at the median end with the base 0·6 mm wide, and the jaw 0·4 mm high; the dental margin is so low convex as to appear almost straight and is 0·9 mm long. There are about 79 teeth on the right ventrolateral jaw. The teeth are narrowly spaced, minute, about 0·018 mm tall at the median end, diminishing very gradually along the row so that teeth in the middle of the row are still 0·015 mm tall. The dorsomedian jaw is housed in an open groove, the ventrolaterals in open pits and the margins of all are so poorly defined that the pits and groove appear non-morphological. The salivary gland papillae are in three rows, small excepting the basal row which has some larger papillae. The dorsal salivary glands form a compact mass in *vii* to *ix* with no indications of columns of aggregated ducts. The extrinsic radial musculature of the pharynx is sparse but forms an obvious system in *viii* and *ix*. The pharynx commences at *vi/vii*. The entrance to the pharynx is narrow, barely wider than the base of the dorsomedian jaw, and the lumen is more simply tubular than tapering. The pharynx has a thin muscular wall with six internal muscular ridges arranged as dorsomedian and ventrolateral pairs, each pair fusing before entering the base of the corresponding jaw, none ending independently on the margin of the entrance to the pharynx. The pharynx terminates in the posterior portion of *ix* followed by a short simple compartment in *ix* as the first portion of the crop which has a short small compartment in *x* with an anterior small and posterior larger pairs of lateral caeca, as also on *xi* to *xviii* in which the compartments increase progressively in length and breadth, the anterior caeca remaining simple, small, and the posterior caeca increasing relatively in size, extending into the paramedian chamber and posteriorly to lie laterally to the anterior caeca of the following somite. In *xix*, the anterior caeca are small and restricted to the median chamber, the posterior pair form elongate postcaeca reflected in the paramedian chamber, reaching to *xxvi* and subdivided laterally into lobes. A short length of the crop completes the compartment in *xix*, connecting terminally at *xix/xx* to the simple tubular intestine which tapers to *xxiv/xxv* where it enters terminally into the short simple rectum.

REPRODUCTIVE SYSTEM. (Fig. 1, F.) The genital pores are at *xi* and *xii* b_5/b_6. The testes are simple saccular. There are normally 11 pairs situated intersomitally at *xiii/xiv* to *xxiii/xxiv*. The vasa deferentia extend in the paramedian chambers to the level of *xi/xii* with the anterior region of each male paired duct folded vertically in a simple primary loop in *xi*. The small epididymis is tortuous on the initial posterior limb of the loop with the muscular ejaculatory bulb on the anterior terminal limb, and the relationship of the organs is sub-parallel. The ejaculatory bulbs are subfusiform. Muscular ejaculatory ducts extend medially into the median chamber to enter independently into the dorsal aspect of the male atrium, not the ventral aspect as is usual, because the male median region is formed on an anteriorly directed primary loop reflecting at *x/xi* so that the atrium is at the posterior end of the procurrent limb continuous with the muscular penis sheath which has the procurrent limb dorsal to the terminal recurrent limb.

The ovaries are elongate and tapering. The short oviducts join just behind ganglion *xii* to form an unusually large thick-walled atrium lined with a longitudinally rugose epithelium. The atrium tapers into the thick-walled common oviduct which is slightly tortuous and continues into the acaecate vagina. The vagina is sharply differentiated from the strongly muscular short thick-walled vaginal duct.

The prostate is a very large thick cap covering the atrium and extending briefly along the procurrent limb of the penis sheath. The albumin glands are a thick investment of the atrium and of most of the common oviduct.

MORPHOLOGY OF THE PARATYPES AND OTHER MATERIAL. Four specimens ranging from 16·0 to 25·0 mm in length. The general form is as in the holotype. The diameter of the posterior sucker is slightly wider than half of the maximum body width, av. 56% (range, 50% to 65%) and most doubtfully of the width of the body excepting in extreme extension of the animal. Colour, as the holotype. Pattern, as the holotype in three specimens with the paired dark bands more pronounced, and all are distinctly maculate, nowhere continuous. The fourth specimen (25·0 mm) has only scattered sparse spaced maculations which do not conform to the topography of the paired bands in the others. Dorsal somital sense organs are distinctly linear on the posterior region of the first three specimens, but very vaguely indicated on the fourth (25·0 mm). Annulation, as in the holotype, excepting in the fourth specimen (25·0 mm) in which *ii/iii* and *iii/iv* cross the paramedian and median fields. In all, there are 16 complete 5-annulate somites, and *xxvi* is 3-annulate above and 4-annulate below.

The differences indicate a possible second species represented by the 25·0 mm specimen.

TWO SPECIMENS FROM THE NILE, NEAR FASHODA. Material from the second collection available to me from the British Museum (Natural History) included two specimens. Data on the label are: *Limnatis nilotica* Savigny. 1907.11.12 1/3. Loc: Nile near Fashoda. Pres: Loat Collection.

The specimens are 39·0 and 49·0 mm long. Preserved, faded, general colour much as in *A. diversa* but slightly darker. Essential pattern as in *A. diversa*, excepting the paramedian field is moderately filled with many dark brownish bold maculations which are erratically placed and blend into the medial and lateral paired bands of this field. This gives the appearance of a broad band across the paramedian field and accentuates the median stripe so making it a prominent feature of the dorsum. This is much as shown in Keegan *et al.* (1969, Fig. 7).

Somital sense organs obscure, but some linear oblique organs are detectable posteriorly on the dorsum; sensillae, arranged as a rosette.

Annulation, as in *A. diversa*, with *ix* to *xxiv* complete 5-annulate (total 16) excepting that *xxiv* a_2 is incomplete briefly in the ventral median field, *xxvi* is simply

3-annulate above and below with the annuli crossing the venter as thin cutaneous folds, and *xxvii*, 2-annulate without an accessory annulus.

Alimentary tract as in *A. diversa*, excepting the intestine joins subterminally to the rectum so that there is a distinct rectal appendix about 2½ times as long as wide. The jaws were not studied for the dentition.

Reproductive system, 39·0 mm specimen. General morphology and morphological relationships as in *A. diversa*, the male median region reflecting at ganglion *x*; excepting that the anterior region of the male paired duct forms a posteriorly directed loop from *xi* into *xii*, on which the epididymis is on the recurrent limb and ventral to the bulb on the procurrent limb, the relationship is subparallel.

Annulation and pattern suggest another possible separate species in *Aliolimnatis*, a question to be decided only from the study of more and preferably better material.

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THE TYPE-SPECIES OF THE GENERA *PHOXINELLUS, PSEUDOPHOXINUS* AND *PARAPHOXINUS* (PISCES, CYPRINIDAE)

By ETHELWYNN TREWAVAS

Phoxinellus Heckel, 1843 : 1040

At this place Heckel listed two species, both new, *P. zeregi* and *P. alepidotus*. *P. alepidotus* was described on the same page; it had already been named on p. 1011, as an example of species having a certain type of pharyngeal teeth. *P. zeregi* was first described on p. 1063. If we were obliged to rely on this publication it would be allowable to have recourse to page-priority, regard *P. zeregi* as a nomen nudum on p. 1040 and adopt *P. alepidotus* as type-species.

Bleeker early (1860a : 423–4) made a formal decision in this sense; he defined *Phoxinellus* and referred to *P. alepidotus* as the typical European species ("de typische[1] europesche soort"); he noted that *P. zeregi* should be placed in a separate genus, for which he proposed the name *Pseudophoxinus*.

In the same year Bleeker (1860b) published a "Conspectus systematis Cyprinorum" in which, though citing no type-species, he defined these two genera in terms consonant with his designation of the respective type-species in 1860a.

In 1863 Bleeker deliberately changed his mind and designated *Phoxinellus zeregi* as "spec. typ." of *Phoxinellus*, citing *Pseudophoxinus* Bleeker as a junior synonym. This appears in three publications of 1863 (1963a; 31; 1863b: 263; 1863c: 209) and in each he proposed a new genus, *Paraphoxinus*, with *P. alepidotus* as type-species.

This is of course inadmissible and Jordan (1919) in 'The genera of fishes' came to this conclusion without citing all the evidence. He in fact recorded the proposal of *Pseudophoxinus* as in the publication here cited as 1860b, noting that no type-species were named in this brief conspectus and stating that they were supplied in the "Atlas" of 1863. He seems to have overlooked our '1860a' and 1860b is wrongly given the date 1859 (which belongs only to the first half of the same volume). Perhaps Jordan was relying on Bleeker's own confession, "Blkr. ol." (Bleeker, formerly), in the publications of 1863. I have not been able to discover in the works of either Heckel or Bleeker any reason for Bleeker's change of mind.

The present note, then, confirms Jordan's view, by giving the evidence, that the only acceptable conclusion is the following:

Phoxinellus Heckel, 1843, type-species *P. alepidotus* Heckel designated by Bleeker, 1860; synonym *Paraphoxinus* Bleeker 1863.

Pseudophoxinus Bleeker, 1860, type-species by monotypy and original designation *Phoxinellus zeregi* Heckel = *Pseudophoxinus zeregi*.

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[1] This can only mean 'type-species'. The other sense of 'typical of the European spp.' could only be assumed if other European species had been known at that time, and this was not so.

Bull. Br. Mus. nat. Hist. (Zool.) 21, 8

Bleeker in his three relevant statements of 1863 did not give the reference to his earlier (1860) designations and his second thoughts have unfortunately been followed by most authors, among them Steindachner (1882), Pellegrin (1923), Berg (1932, Zoogeographica), Karaman (1924), Tortonese (1938), Steinitz (1953) and Ladiges & Vogt (1965). Only Günther (1868) used *Pseudophoxinus* as a subgenus (of *Leuciscus*) with the single species *'Leuciscus' zeregi*, but he banished *Phoxinellus* altogether by using *Paraphoxinus* for *P. alepidotus* and putting *Phoxinellus* in the synonymy of both *Leuciscus* and *Paraphoxinus*!

The taxonomy of these little circum-Mediterranean Cyrpinidae is very unsettled, and authors who have recognized *P. alepidotus* and *P. zeregi* as type-species of distinct genera have not agreed on the limits or definition of the genera, either with regard to each other or in relation to *Pararhodeus* Berg and *Rutilus* (especially *R. tricolor* (Lortet); but see Banarescu, 1960 : 67 and 119). The type-species of *Phoxinellus, P. alepidotus*, belongs to a group of populations characterized by various degrees of reduction of the squamation, associated with life in water whose course runs now in the open, now underground in limestone country in Yugoslavia. Even the specific boundaries are in doubt and the generic value of the reduction of scales is questionable. The problem has been stated by some of the authors mentioned above.

To avoid misunderstanding I should say that I have no plans to work towards a solution myself. The need to consider *P. zeregi* in another context prompted me to look into the nomenclature.

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